Chapter 3 – Affected Environment & Environmental Consequences

Table of Contents

CHAPTER 3 – AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter discusses the Existing Condition/Affected Environment of the resources and the anticipated effects of each of the alternatives.

"Affected environment" is a term that refers to the existing biological, physical, and social conditions of an area that are subject to change, directly, indirectly, or cumulatively as a result of a proposed human action. Information on affected environment is found in each resource section under the heading "Existing Condition/Affected Environment".

This section is a summary of information and analysis found in specialist reports (see project record) with supplemental information provided directly into the EA.

The references listed in Chapter 4 and cited throughout Chapter 3 establish the consideration of the best available science being used to complete this analysis.

Framework for Cumulative Effects Analysis

Residual impacts of past actions, activities, or disturbances are represented in the description of the current condition for each resource. The incremental impacts associated with on-going and reasonable foreseeable future actions will be considered as additions to the direct and indirect effects of the action to determine cumulative effects. Looking out over the next 5-10 years, there are no reasonably foreseeable future actions proposed in the project area. Ongoing actions include low levels of road related recreation and dispersed camping, hunting, livestock grazing, and firewood cutting.

"Cumulative impact" is defined in the Council on Environmental Quality (CEQ) NEPA regulations as the "impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions…"*40 CFR 1508.7.*

The cumulative effects analysis in this EA, for each resource, focuses on those past and ongoing actions and activities whose effects have a geographical and timing overlap with the direct and indirect effects of the proposed action or alternatives. Such a relationship defines relevancy for the cumulative effects analysis.

The subwatersheds included in the Black Hills Project planning area have not experienced any vegetation management activities or new road construction since the late 1980s.

In general, there is a limited potential for a geographical and timing overlap to occur between the residual impacts from past activities or actions and the direct/indirect effects attributed to the alternatives of the Black Hills Project.

Issue #1 - Forest Plan Amendment for Treatment of Allocated Old Growth

Proposed thinning treatments within Forest Plan allocated old growth (MA 3 and MA 14) may adversely impact old growth dependent species or their habitat.

Existing Condition/Affected Environment

Within the Black Hills Project planning area, the Forest Plan allocates approximately 2,633 acres of lodgepole pine, ponderosa pine and pine-associated forested stands to habitat for old growth dependent species (MA 3 and MA 14). Connectivity corridors between old growth habitats have been identified per Regional Forester's Eastside Forests Plan Amendment 2 (Eastside Screens).

The Forest Plan allocates about 675 acres of "dedicated" old growth ponderosa pine areas for goshawk habitat within the planning area. The Forest Plan also allocates about 264 acres of "dedicated" old growth pine-associated areas for goshawk habitat. Approximately 1,694 acres of "managed" old growth lodgepole pine have been allocated for three-toed woodpecker habitat. This area of the Fremont National Forest is considered to be outside of the range of three-toed woodpeckers. Since black-backed woodpeckers have similar habitat requirements, the Forest substitutes this species for three-toed woodpeckers.

The Forest Plan allocates approximately five percent of the Forest to increase and/or manage stands of old growth on the Forest to maintain minimum viable populations of dependent, native vertebrate species. In addition to these allocated old growth acres, there are areas with old growth or "late and old structural" (LOS) characteristics that do not specifically fall under the Forest Plan direction for managing old growth. Like the majority of the Fremont-Winema National Forest, these 'non-allocated' old growth areas are managed, under Regional Forester's amendments to the Forest Plan with the objective of retaining and promoting the Late/Old structural (LOS) characteristics in the stand.

Similar to pine and pine-associated (also called mixed conifer) forested conditions elsewhere in the Black Hills Project planning area, increased stand densities and fuel levels put these old growth stands at risk of high intensity wildfire and insects, such as bark beetles. The objectives of proposing treatments in pine and pine-associated "dedicated" old growth stands are: 1) retention of all old trees taking into account age and diameter; and 2) thinning of young growth trees predominantly white fir and lodgepole pine to protect residual old growth and promote sustainable conditions.

Lodgepole in the planning area have experienced increased mortality from mountain pine beetle in the past five years. Tree densities in the "managed" old growth lodgepole stands are high, reaching over 1,000 stems per acre. Around 800 trees per acre are in the 1-7" DBH class and the rest are in the 7-12" DBH class. On the Fremont National Forest just east of the Black Hills Project, large areas of lodgepole are dead or dying due to an outbreak of mountain pine beetle.

The FEIS for the 1989 Fremont Forest Plan envisioned most lodgepole stands on the Forest being converted to a managed state within two decades of implementation. It was expected that few

overmature lodgepole stands other than those maintained for other resources (i.e. wildlife) would remain. Most lodgepole stands on the Fremont National Forest, and particularly in the Black Hills Project planning area, have not been converted to a managed state. Lodgepole pine stands in the planning area are fairly uniform in age and size – mature/overmature – and therefore equally susceptible to wildfire and mountain pine beetle attack. The objectives of proposing treatments in the "managed" lodgepole old growth are 1) promote restoration of the aspen component of these stands; 2) promote a second cohort by creating small openings and providing for natural regeneration; and 3) develop within stand seral stage diversity.

Environmental Consequences

Effects Common to Alternative 1 and Alternative 3

Under these alternatives, allocated old growth stands, both "dedicated" and "managed", would not be entered for thinning. These stands would continue struggling for resources and be at risk of insect attacks and stand replacing wildfires due to ladder fuels. Conditions are, and would continue to be ripe for large increases in bark beetle caused mortality, with large desirable trees at most risk. Since there are a limited number of large diameter trees, eventually this habitat component would be limited.

Stand structures would remain the same in the near term, with a continuation of increased density and layering. This would favor species that are provided habitat from closed canopies such as goshawks, pine martens and canopy nesting birds. Long term the risk of stand replacing events such as insect outbreaks and stand replacing fire would continue to increase. Stand replacing events, fire or insects, would eventually have the result of reducing late, old and mid succession forest to earlier stages. When this occurs, these stands would then favor disturbance dependant species such as black-backed woodpeckers.

As stand densities near maximums (a large number are there or nearing that level now), density dependent stress mortality would increase. Individual large and medium diameter conifers would continue to die from site resource competition and continued insect and disease mortality. This would provide a habitat pulse for species that require large diameter snags such as pileated woodpeckers. There would be little or no increase in understory grasses, forbs and brush species which could limit habitat for prey species. These plants would continue to decline as litter layers deepen and conifers continue to utilize the limited site resources.

Alternative 2 – Proposed Action

The Forest Service proposes an amendment to the Forest Plan to utilize a commercial timber sale to thin about 471 acres of pine and 183 acres of pine-associated "dedicated" old growth under Alternative 2. Treatments would be focused on maintaining or promoting LOS conditions, while creating resilient forest conditions that would benefit old growth species.

Kolb et al. (2007) report that the thinning of neighboring trees often increases water and carbon uptake of old trees within 1 year of treatment, and increases radial growth within several years to two decades post treatment. However, growth stimulation of old trees by thinning may be inhibited by drought.

Thinning young to mid-story trees in these areas would enhance the existing old trees by allowing them more growing space and relieving them of competition. Recent studies have shown that reducing stand densities does increase growth of old trees (Franklin and Johnson, 2009).

Stand structures would be modified and moved towards more open stand conditions with decreased density and layering. This would favor species that are provided habitat from open canopies and larger trees such as white-headed and pileated woodpeckers. Long term the risk of stand replacing events such as insect outbreaks and stand replacing fire would be decreased. Without stand replacing events, there is a greater assurance of retaining these stands across the landscape over time. These stands would then continue to favor old growth dependant species.

Stand densities would be restored to those that are more resilient and sustainable. Ladder fuels would be reduced, and the potential for a crown fire in treated old growth stands would be reduced. Individual and large diameter trees would be retained at a greater rate because they would be healthier. Therefore, this habitat component would continue to be provided across the landscape. There would be an increase in understory grasses, forbs and brush species, which would provide more habitats for prey species.

Goshawk surveys were conducted within the planning area during the 2006 and 2007 field seasons and no goshawk nests were located. Two goshawks were heard, but neither they nor their nests could be located. There were also two incidental sightings, but follow-up visits in those areas did not locate the birds or a nest. Based on the size of the project area, there may be nesting goshawks in the proposed project area, but they have not been located.

Desimone (1997) found that re-occupancy of nest sites in the Fremont National Forest was clearly related to the amount of mid-aged and late structural forest stages having >50% canopy closure. A design feature of this project is to retain 5-15% of each unit in untreated patches. This would contribute to diversity within stands, and be beneficial in providing denser patches that would contribute to goshawk habitat across the landscape. It is expected that the "dedicated" pine and pine-associated old growth stands would still provide habitat for goshawks after treatments.

Alternative 2 would also treat about 726 acres of "managed" lodgepole old growth or 43% of the total allocated lodgepole old growth in the planning area. Existing old growth lodgepole stands would be treated without designating other stands as replacement old growth. All of the lodgepole stands in the planning area are generally the same age – mature/overmature – and therefore equally susceptible to wildfire and mountain pine beetle attack. Treatment in selected stands would promote development of a second cohort sooner than under natural processes. This would create two different age classes throughout the stands, therefore making the stands more resilient to mountain pine beetle. Reducing the lodgepole pine dominance where aspen exists would provide for restoration of aspen stands where they historically occurred.

Treatments in "managed" lodgepole pine old growth stands would provide some seral stage diversity so that at least portions of the stands will provide habitat faster in the future, which would be a long-term benefit. At the same time, there will be a short-term decrease in black-backed woodpecker habitat quantity and quality on approximately 363 acres of "managed" lodgepole pine old growth

within the planning area, although these areas would be able to still function as old growth for black-backed woodpeckers as existing snags would be retained in these stands.

Scenario A (4) in the Eastside Screens identifies that timber harvest within old growth connectivity corridors may occur if criteria in A (2) of the Eastside Screens is met, which the proposed action alternative would do. The proposed action includes treatments that would result in healthier more resilient stands that are moving towards late and old structural stages. Diversity across the landscape would be provided by retention of 5-15% untreated areas within treatment units greater than 20 acres, riparian habitat conservation areas, areas outside treatment units, and the mosaic created during prescribed burning. The intent of the proposed action alternative is to move stands towards providing late and old structural stages across the proposed project area by improving resiliency and stand health, which would improve old growth connectivity across the landscape over the long-term. The proposal would continue to provide for connectivity between old growth habitats.

This proposed Forest Plan Amendment is consistent with the requirements of the 2000 Forest Service planning regulations (36 CFR 219). Criteria in Forest Service Manual (FSM) 1926.52, Changes to the Land Management Plan that are Significant and 1926.51 for Changes to the Land Management Plan that are Not Significant provide direction for amending the Forest Plan.

The following examples indicate circumstances that may cause a significant change to a land management plan:

1. Changes that would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected (see section 219.10(e) of the planning regulations in effect before November 9, 2000 (see 36 CFR parts 200 to 299, revised as of July 1, 2000)).

2. Changes that may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area during the planning period.

Changes that would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected (see section 219.10(e) of the planning regulations in effect before November 9, 2000 (see 36 CFR parts 200 to 299, revised as of July 1, 2000)). The amendment is limited to the site-specific situation in the Black Hills Project area and does not apply to future decisions of any other areas. This amendment does not change the allocation of old growth provided by the Forest Plan. It does not in any measurable way alter the levels of multiple-use goods and services originally projected by the Forest Plan.

Changes that may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area during the planning period. The amendment is limited to the site-specific situation on up to approximately 8,600 acres in the Black Hills Project area and does not apply to future decisions of any other areas.

This amendment is being proposed specific to the Black Hills Project in association with Forest Service policy found at FSM 1926.51. Changes to the Land Management Plan are considered not significant when:

1. Actions do not significantly alter the multiple-use goals and objectives for long-term land and resource management.
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.
3. Minor changes in standards and guidelines are proposed.
4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

Actions do not significantly alter the multiple-use goals and objectives for long-term land and resource management. This amendment is specific to the Black Hills Project and does not apply to other actions. It does not alter the multiple-use goals or objectives of the Forest Plan. This action would be consistent with the Forest Plan goal to manage stands of old growth on the Forest to maintain populations of dependent, native vertebrate species (Forest Plan pages 137-139 and 196-198). Treatment activities would enhance old-growth habitat and provide for maintaining healthy stands of old growth into the future.

Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management. This amendment would not change any management boundaries. This amendment proposes adjustments to the management prescriptions for specifically identified "dedicated" pine and pine-associated and "managed" lodgepole pine old-growth stands in the Black Hills Project. The amendment would involve a total of 1,380 acres. The amendment here would not cause significant changes in the multiple-use goals and objectives for long-term land and resource management of the Fremont National Forest.

Minor changes in standards and guidelines are proposed. This amendment proposes to change the standard and guidelines for "dedicated" pine and pine-associated old growth that states "*Old-growth pine and pine-associated stands are dedicated, i.e. receive no timber management.* Alternative 2 proposes commercial thinning of about 471 acres of pine and 183 acres of pine-associated old growth. Treatments would be focused on maintaining or promoting LOS conditions, while creating resilient forest conditions.

This amendment also proposes to change the standard and guidelines for "managed" lodgepole pine old growth that states: "*Old growth lodgepole pine stands will be managed on a 120 year rotation. Select and place under management replacement stands, with emphasis on stands with the earliest replacement potential.*" This proposal would treat about 726 acres of "managed" lodgepole old growth without designating other stands as replacement old growth. This change would apply to approximately 726 acres of "managed" old growth lodgepole.

This amendment does not change the allocation of old growth habitat; it only seeks to improve conditions for the long-term health of these stands.

Opportunities for additional projects or activities that will contribute to achievement of the management prescription. The amendment would apply only to the identified old growth stands in the Black Hills Project; no other projects or activities would be affected by this amendment.

Cumulative Effects

Ongoing actions including low levels of road related recreation, dispersed camping, hunting, livestock grazing, and firewood cutting would not impact allocated old growth. There are no reasonably foreseeable future projects expected in the next 5 to 10 years in the planning area. There would not be any cumulative effects to allocated old growth as a result of implementing Alternative 2 or 3 of the Black Hills Project.

Issue #2 - Economics of Helicopter Logging _____

It may not be economically feasible to thin stands in the steep areas on and around Spodue Mountain by use of helicopter logging.

Existing Condition/Affected Environment

Alternative 2 (Proposed Action) of the Black Hills Project contains an estimated 2,600 acres proposed for helicopter logging. This project does not have the same objectives as a traditional timber sale, which primarily would be to offer wood products in the most cost efficient manner. Objectives for the steep areas on and around Spodue Mountain are to reduce fuel loadings and the risk of high severity wildfire, protect Spodue fire lookout and communication facilities, maintain and enhance conditions for LOS components, and improve overall forest health while allowing fire to play a more natural role on the landscape. Alternative 2 proposes to achieve these objectives through thinning with helicopter yarding, followed by application of prescribed fire, while Alternative 3 would look to meet these objectives primarily through the use of prescribed fire. Cost efficiency is desirable, but should not drive the project.

It is generally known that utilizing helicopters to yard harvested trees from treatment areas is an expensive activity relative to ground-based yarding systems. Helicopter operations, however, can be very efficient and an effective way of removing thinned trees from forested areas on steep slopes. Not long ago, Region 6 officials sponsored a meeting with helicopter operators and the Willamette, Mt. Hood and Siuslaw National Forests to discuss the reduction in helicopter work on the Forests during the recent downturn in the wood products industry. The American Forest Resource Council (AFRC News letter, February 19, 2010) reported the following from the meeting: "It was well understood by all that in these economic times, the types of material the Forest Service wants to remove (small diameter thinning) will not pay its way out of the woods." It was recognized that other money would be needed to help in subsidizing the costs of helicopter yarding systems, if they were to be utilized in this depressed market. This is where we find ourselves in regard to the proposed helicopter logging in the Black Hills Project.

Environmental Consequences

Alternative 1 – No Action

Alternative 1 would result in no active management of the resources except for ongoing low levels of road maintenance, livestock grazing, firewood gathering and recreation. No additional costs would be incurred; however Alternative 1 would generate no goods or services to the local and regional economies.

Effects of Alternatives 2 and 3

The 2,600 acres proposed for helicopter logging under this alternative are expected to produce approximately 4-5 mbf per acre of harvested timber resulting in a total of 10,400-13,000 mbf.

The stump-to-truck cost of helicopter logging is estimated to be around $350 per mbf for this project. In comparison, ground-based logging system costs average about $180 per mbf here locally. Bid rates received for sales of green sawlog material (ground-based logging) on the Fremont-Winema National Forests in 2009-2010, outside the Lakeview Federal Stewardship Unit, have averaged about $34.00 per mbf. Therefore, it is expected that the potential value of sawtimber produced by treating these 2,600 acres would not be sufficient to cover the costs of helicopter logging. It is estimated that $1.8 - $2.2 million would be needed to subsidize the cost of helicopter logging unless timber values rise substantially in the near future.

Much of the work done on National Forests, other than traditional timber sales, are funded through a variety of means, including appropriated funds, partnerships with other agencies or private entities, and service or stewardship contracts. Those same options would be considered as ways to fund the restoration work under this project.

Without the helicopter thinning, Alternative 3 would not reduce potential wildfire behavior or severity as effectively in the steep areas on and around Spodue Mountain because ladder fuels and canopy bulk density would remain high. Several entries of prescribed fire treatment would be needed to reduce fuels to acceptable levels and bring about desired stand conditions.

Cumulative Effects

There are no past, ongoing or foreseeable future projects that would contribute to cumulative effects when added to the proposed actions of Alternative 2 or 3 in regard to logging costs.

Tribal Consultation and Treaty Rights

Introduction and Background

The Black Hills Project area is within former reservation lands of the Klamath Tribes. The Klamath Tribes are a federally recognized Indian Tribe comprised of the Klamath, Modoc and Yahooskin Band of Snake Indians. Tribal members consider the Black Hills area to be a special place that holds importance to their culture and heritage.

In 1864 the Klamath Tribes signed the Klamath Lake Treaty ceding over 13 million acres of their lands to the United States government. About 1.1 million acres were retained for the Klamath

Reservation. The boundary of the reservation shrank to 862,622 acres by 1954 due to several land exclusions (Zucker et. al., 1983:107-108). Throughout this time, the area was managed by the Department of the Interior, Indian Service (known today as the Bureau of Indian Affairs). In 1954 Congress terminated the Klamath Tribes' federal status under the Federal Termination Act, while retaining their ability to exercise their treaty rights on the former reservation lands. Private entities bought some of the former reservation land, but the majority of it became the Winema National Forest in 1961 (Zucker et.al., 1983:110). The Fremont National Forest received large, scattered blocks of the former reservation land totaling 96,000 acres, one of which was the Black Hills area (Bach, 1981:14-15) (Durant, 2010 Cultural Resource Specialist Report for Black Hills).

Federal Recognition of the Klamath Tribes was restored in 1986. When the Tribes entered into the Klamath Lake Treaty, with the United States in 1864, they reserved, among other things, the right of Tribal members to hunt, fish, trap and gather on their reservation lands for their livelihood in perpetuity. Federal courts have held that these rights have survived the termination of the Tribes and the transfer of ownership of their reservation.

The United States has a trust responsibility to protect the Klamath Tribes' Treaty rights. Under this trust responsibility, the Forest Service is required to consult with the Tribes to ensure that the Tribes Treaty rights, and the resources on which those Treaty rights depend, are protected to the fullest extent possible. The United States Department of Agriculture (USDA) Forest Service, by and through the Regional Forester of the Pacific Northwest Region (Region 6) signed a Memorandum of Agreement (MOA) along with the Chairman of the Klamath Tribes in 1999 to facilitate government–to-government consultation. The MOA was amended in 2005 following a review of the implementation of the agreement by the Regional Forester and the Tribes.

The Fremont-Winema National Forest regularly consults with the Klamath Tribes on management activities. The Klamath Tribes were first introduced to the Black Hills Project at a Pre-Schedule of Proposed Actions (SOPA) meeting in the fall of 2003 and has subsequently been discussed at quarterly Pre-SOPA meetings since. The Tribal Forester was very interested in seeing the Forest Service consider restoration activities in the Black Hills area. While the Forest Service was reviewing conditions in the area to identify potential treatment areas, the Tribal Forester was also working on identifying areas he thought warranted treatment.

While on an initial tour of the Black Hills Project area with Forest Service staff in 2005, the Tribal Forester lead the group to an old growth stand along Road 3462, explaining that it was considered very important to the Tribes and suggested that thinning treatment would be appropriate to maintain the old large ponderosa pine trees. At the time, the area was not included in the project planning boundary, which was confined to the area within the Sycan River and Snake River subwatersheds. Subsequently, a portion of the Marsh Reservoir subwatershed, which includes the old growth area of interest, was added to the project planning area.

As part of ongoing consultation with the Tribes, the Forest Service met with the Tribal Forester and Wildlife Biologist in February of 2009 to review and discuss a potential proposed action for the Black Hills Project. The areas recommended for thinning treatments by the Forest Service and by the Tribal Forester were over-laid together on a map to look at similarities and differences. This

resulted in additional areas of thinning treatment being included in the final proposed action that was scoped to the public and is identified as Alternative 2 in the EA.

Hard copies of the proposed action scoping letter were sent to the Chairman and Directors on June 10, 2009. That same day, copies of the scoping letter were sent by email to the Tribes' Department Directors.

As the Forest Service Interdisciplinary Team worked to define the alternatives for the project, the Tribal Forester and Wildlife Biologist were instrumental in helping to design the project (notes of meetings and field tours in project file).

Consultation with the Klamath Tribes occurred prior to conducting cultural surveys, during surveys, and after surveys. Forest Heritage personnel discussed the project with the Tribes' Cultural and Heritage Department representative, Les Anderson, on February 3, 2009 and April 28, 2009. An update on the progress of the Black Hills project was provided to the Klamath Tribes Culture and Heritage Director, on January 12, 2010.

Issues of importance to the Tribes include the protection and enhancement of Treaty and trust resources, including but not limited to the following: impacts on habitats affecting fish, plants, wildlife populations and protection of cultural resources. The Tribes also have an interest in road management and motor vehicle control in areas impacting the Tribes Treaty rights.

The Forest Service obtained lists of plant and wildlife species that are of tribal concern from the Tribes Wildlife Biologist (lists available in the project record). Potential impacts to these plant and wildlife species from implementation of the Black Hills Project are addressed below.

Plant Species of Tribal Concern
There are several plant species of tribal concern that exist within the project boundary. For ease of discussion, plant species of tribal concern have been divided into three groups based on their habitats. The first group will be those species that exist within riparian areas. The second group will be for those species that exist within scabland habitats, while the third group will be for those species that exist within forested habitats. Some species may exist in one or more of these groups.

Environmental Consequences

Alternative 1 – No Action

Riparian Habitat: Many of the plant species of tribal concern that reside within riparian habitats are early colonizers, thus being shade intolerant. The No Action alternative would leave the project area in its current condition. In the current state, riparian areas would continue to experience encroachment, which would increase shade in this habitat type. In the No Action alternative, fuel reduction activities would not occur, including prescribed fire within the riparian areas. Current fuel trends would continue to build increasing the risk for impacts from high severity wildfires. Most of the culturally important plant species respond favorably to low to moderate severity fire; many culturally important plants may be lost on portions of the landscape when a high severity fire occurs.

Non-Forested/Dry Meadow Habitat: There is a portion of non-forested/dry meadow communities (scablands) within the project boundary. In the No Action alternative, encroachment into dry meadows by either juniper or conifers would continue, thus reducing suitable habitat. Non-forested/dry meadows are areas with a low probability of fire spread, so the proposed fuels reduction activities in the action alternatives surrounding the dry meadows would have little to no impact on these plant species of tribal concern.

Forested Habitat: Many of the plant species of tribal concern that reside within forested habitat tolerate little to partial shade. Since the No Action alternative would leave the project area in its current condition, the canopy closure would continue to increase, thus decreasing suitable habitat. In the No Action alternative, fuels reduction activities would not occur. These types of activities would reduce the risk for a future high severity fire in the project area. Most of the plant species of tribal concern tolerate low to moderate fire severity, but not a high severity fire.

Effects Common to Alternatives 2 and 3

Riparian Habitat: The vegetation treatments would reduce the riparian encroachment that has occurred within the area of intermittent streams. Reducing the conifer encroachment would increase the amount of unshaded riparian habitat, thus promoting the majority of plant species of tribal concern within riparian habitat. The action alternatives also propose prescribed burning as a fuels reduction activity. Most plant species of tribal concern respond favorably to a low to moderate severity fire, which would act to increase or promote plant species of tribal concern. The majority of plant species of tribal concern within riparian habitat would respond favorably to the proposed activities of the action alternatives.

Non-Forested/Dry Meadow Habitat: The edges of dry meadow habitat are proposed for harvest and prescribed burning. Due to Project Design and Resource Protection Measures, including BMPs, mechanical equipment cannot be used in meadows, but can reach into and around the edges. Falling trees by hand is another option for this area. By reducing the encroachment of conifers and juniper onto meadows, it would promote habitat for plant species of tribal concern. Meadows do not burn easily due to a lack of contiguous fuels. Therefore, burning within the non-forested/dry meadows would be spotty. A spotty burn would be beneficial for most species located within this habitat. The majority of plant species of tribal concern within non-forested/dry meadow habitat would respond favorably to the proposed activities of the action alternatives.

Forested Habitat: Many of the plant species of tribal concern that reside within forested habitat tolerate little to partial shade. The proposed vegetation treatments, including prescribed burning would increase the canopy opening within units. In addition, the majority of plant species of cultural concern respond favorably to low to moderate severity fire. The majority of plant species of tribal concern within forested habitat would respond favorably to the proposed activities of Alternatives 2 and 3.

Tribal Terrestrial Wildlife Species of Interest/Concern

These are the species identified by the Tribes' Natural Resource Department to be of interest to the Klamath Tribes at this time. There may be other species of interest to the Tribes that are unknown and not listed at this time. The table below presents a summary of the potential effects to species

and/or their habitat. Detailed discussion of potential effects to a species or its habitat that occur within the planning area can be found in the Terrestrial Wildlife section of this EA.

Effects Determination Code
NI = No Impact from the project on the species or its habitat
EIH = Project may cause effects to individuals or habitat.

Table 3-1. Effects to Klamath Tribes' Species of Interest/Concern

Species	Species and Habitat Attributes	Species and/or Habitat Present	Effects of Action Alternatives
American "pine" marten (*Martes americana*)	Closely associated with late-successional or mixed-age stands of mesic conifers, especially those with complex physical structure near the ground, such as wet lodgepole or red fir areas. Seventy percent of all dens located have been in standing trees, logs or snags in large structures characteristic of old-growth forests (Ruggerio, et al., 1994). Will also utilize large stumps as resting sites. Hunt small mammals by traveling on the ground or over snow. Prey beneath snow caught through access points to the subnivean space created by coarse woody debris. Also eats insects, small birds, fruits, and carrion.	Habitat	EIH
American peregrine falcon (*Falco peregrinus anatum*)	Cliffs averaging 230 feet high, within 1 mile of a riparian area. Nests on ledges at 40 – 80% of cliff height, with view of surrounding area. Primary prey are birds (Pagel, 2004).	No	NI
American white pelican (*Pelecanus erythrorhynchos*)	Lakes and freshwater marshes, with nests on sparsely vegetated islands. Piscivorous.	No	NI
Bald eagle (*Haliaeetus leucocephalus*)	Bald eagles feed on fish, small mammals, waterfowl and carrion. Nests are usually in multi-storied stands with old growth components, near the water, and are in the largest live trees in the area with tree canopy covering the nests to varying degrees (USFWS, 1986).	Yes	EIH
Black bear (*Ursus americanus*)	Forested areas, particularly in vicinity of water. Tend to select early seral, brushy habitats. Also utilize wet meadows in spring and early summer. Seasonally forage on new grass and forbs, tree cambium, insects in rotting logs, acorns, nuts, and berries. Occasionally eat fish, carrion or newborn ungulates. Dormant in dens under stumps or logs, or in other holes, usually well hidden by brush, from approx. October/November – March/April.	Yes	EIH

Table 3-1 (Continued). Effects to Klamath Tribes' Species of Concern

Species	Species and Habitat Attributes	Species and/or Habitat Present	Effects of Action Alternatives
Blue grouse (*Dendragapus obscurus*)	Coniferous forest, and grass/shrubland near forest edges. Dwarf-mistletoe brooms in Douglas-/subalpine fir used for thermal protection. May also roost under snow in winter. Seasonally forage on arthropods, conifer seeds/needles/stems/buds, forbs and berries.	Yes	EIH
Bobcat (*Lynx rufus*)	All habitats except intensively cultivated lands and high altitudes; avoid deep snow. More common in early successional stages where understory is dense and prey abundance is greatest. Most critical feature of habitat is ledges, or bogs, and proximity to escape cover. Prey on a variety of small mammals and birds.	Habitat	EIH
Canada lynx (*Lynx canadensis*)	The Fremont-Winema National Forest is not within the current range of the lynx (Gaillard and Folger, 2002). The Forests have some components of lynx habitat, but not in sufficient quantities to sustain viable populations. Based upon current knowledge, the Forests do not have plant associations that can be developed into sufficient suitable habitat for lynx. As its primary prey, good snowshoe hare habitat is considered good lynx habitat. Snowshoe hare habitat consists of dense conifer thickets interspersed with small patches of grasses, forbs and ferns. In addition, lynx prefer high altitudes with deep winter snow cover.	No	NI
Elk (*Cervus elaphus*)	Require a mosaic of early, forage producing stages and later, cover-forming stages of forest in close proximity. Diets in summer are almost evenly divided between grasses and sedges, forbs, and woody plants, with grasses being consumed more in the early summer, and forbs or browse species being consumed extensively in late summer. In winter, ponderosa pine can be up to 65% of their diet, but more normally sedges and grasses are in high proportions, and shrubs contribute relatively little to elk diets in winter. Approx. 90% of elk foraging areas occur within ≈ 400 feet of cover that is sufficient to hide 90% of a standing elk at ≈ 200 feet.	Yes	EIH
Great grey owl (*Strix nebulosa*)	Nest in mature conifer stands with greater than 60% canopy closure, many leaning trees and much dead and down material. The nest stands are generally within 1000 feet of a natural meadow or man-made openings larger than 10 acres (USDA, 2004).	No	NI

Table 3-1 (Continued). Effects to Klamath Tribes' Species of Concern

Species	Species and Habitat Attributes	Species and/or Habitat Present	Effects of Action Alternatives
Greater sage-grouse (*Centrocercus urophasianus*)	Sagebrush obligates. Big sagebrush habitats used more often than low sagebrush.	No	NI
Mule deer (*Odocoileus hemionus hemionus*)	Occupy a wide range of habitat types. In general, occupy more open but rugged areas. Fawning areas follow snowmelt, and are characterized by a dense shrub layer (near 40%), typically found on productive north slopes with less than 5% juniper cover (Miller, 1999). Forbs compose up to 50 – 75% of their summer diet, but only 10% in the winter. In winter, deer browse the new growth on twigs from plants with high fat content such as sagebrush, rabbit-brush, juniper, bitterbrush and mountain mahogany. Mule deer winter range habitat is generally in the valley bottoms below 4500 feet, and usually includes big sagebrush, curly-leaf mountain mahogany, bitterbrush and some ponderosa pine.	Yes	EIH
Northern goshawk (*Accipter gentilis*)	Found in mixed-conifer habitats, may also utilize open stands of lodgepole, ponderosa pine and aspen. Mosaic foraging areas include large trees, snags, and down logs interspersed with openings supporting a large range of suitable prey, especially species that are ground dwellers or occur near the forest floor. Often found in riparian areas, as the habitat type most likely to support their prey base of small mammals and birds. Nests are usually built in one of the largest trees within 20 – 40 acre dense patches of large old trees.	Habitat	EIH
Northern spotted owl (*Strix occidentalis*)	Spotted owls inhabit late-successional and old-growth Douglas-fir forests with multiple canopy layers, canopy gaps, and patchy understory (USDA, 1994). Predominant prey species are northern flying squirrels and dusky-footed woodrats (Gutierrez, et al., 1995).	No	NI
Pacific fisher *(Martes pennanti)*	Fishers occupy low and mid-elevation forests with a continuous canopy in which deep snowpacks do not accumulate. Denning and resting sites have complex physical structure characteristic of late-successional forests, including large trees and snags, coarse down woody debris and other complex structure near the ground, and multiple-layered vegetation. Associated with riparian areas, and avoid areas with little forest cover or significant human disturbance. Natal dens are located in cavities in relatively large trees or snags at heights exceeding 20 feet (USFWS, 2004).	No	NI

Table 3-1 continued. Effects to Klamath Tribes' Species of Concern

Species	Species and Habitat Attributes	Species and/or Habitat Present	Effects of Action Alternatives
Pileated woodpecker (*Dryocopus pileatus)*	Dependent on large-diameter trees with decay for nesting, roosting and foraging. Primarily found in dense, mixed-conifer forests in late seral stages or in deciduous tree stands in valley bottoms. Rarely found in stands of pure ponderosa pine.	Yes	EIH
Pronghorn antelope (*Antilocapra americana*)	In Oregon, broad areas dominated by big sagebrush and playas are the primary habitats. Also use areas of widely spaced junipers or ponderosa pines. Free water or succulent plants predominant factors influencing site use. Forage primarily on sagebrush and other shrubs, forbs, occasionally on grasses. Have been observed using the forested meadow edges south of the Sprague River Road, 7 miles northeast.	No	NI
Pygmy rabbit (*Brachylagus idahoensis*)	Historic in Klamath County, but no longer resident. Construct burrows at the base of sagebrush. Diet of big sagebrush and grasses, occasionally forbs.	No	NI
White-headed woodpecker (*Picoides albolarvatus*)	Open canopy, large-diameter ponderosa pine dominated forests. Forage primarily on ponderosa pine seeds. Excavate nest cavities in snags >25" dbh, leaning logs, stumps or dead treetops.	Habitat	EIH

Note-: Animals not listed here does not imply a lack of importance to the Klamath Tribes.

The proposed Black Hills Project may affect habitat and species as identified above in Table 3-1 above. Although these species and their habitat may be affected during implementation of the proposed project, it is expected that the area would continue to provide habitat for these species at a level consistent with that which can be provided by healthier, more resilient, and sustainable vegetative conditions.

Fisheries Resources

Year-round habitat for aquatic species within the project area is limited to the Sycan River; seasonal habitat is available in tributaries connected to the Sycan River when water flow is sufficient.

- Bull trout occur within the upper Klamath Basin. Bull trout have been documented in the Upper Sycan River and its tributary Long Creek, just upstream of the project area, but have not been documented in the Lower Sycan River. Critical habitat for bull trout is designated upstream of the project area in the Upper Sycan River and the Sycan Marsh, but does not extend downstream to the Lower Sycan due to lack of potential habitat.

- Lost River and shortnose suckers - No Lost River suckers have been found to occupy the Sycan River. Shortnose suckers have been documented in the Sycan River directly downstream of the project area, below Coyote Bucket and the National Forest System Land

boundary. Shortnose suckers are known to hybridize with Klamath largescale suckers, which also reside in the Lower Sycan River within the project area. Critical habitat for Lost River and shortnose suckers is designated approximately five miles downstream of the project area, off Forest.

- Redband trout occur throughout the Lower Sycan River Watershed and therefore occupy habitat within the project area. The Fremont Forest Plan (1989, as amended) identifies the trout family as a management indicator of riparian/stream ecosystem health. Species in the project area that are members of the trout family are redband, brook, and brown trout. Redband trout are used in the MIS (Management Indicator Species) effects analysis, because redband trout are thought to be a better indicator of local riparian/stream ecosystem health than non-native brook or brown trout, as redband trout are a native fish species and a Region 6 Sensitive Species. Redband trout occupy 15.5 miles of habitat within the analysis area.

- Other Native Fish Species - The Lower Sycan River within the analysis area contains native non-listed fish species such as Pit- Klamath lamprey, speckled dace, tui chubs, marbled sculpin and Klamath largescale sucker. Another lamprey species, generally described as 'landlocked Pacific lamprey' is also reported here. This misidentified lamprey is genetically distinct from the anadromous Pacific lamprey and is referred to as the Klamath Lake lamprey (personal communication, S. Reid, 2010); the lamprey is a freshwater resident that migrates from the Upper Klamath Lake to spawn in the Sprague River and its tributaries.

The project is not expected to result in direct effects to bull trout, shortnose suckers, Lost River suckers, or redband trout as no activities are expected to take place in any fish-bearing stream channel. The commercial and small tree thinning portions of this project would not retard or prevent attainment of Riparian Management Objectives (RMOs) or adversely affect native fish (TM-1and FM-1 of INFISH), as no adverse direct or indirect effects to any fish species is expected. Road decommissioning or maintenance and prescribed burning could occur adjacent to occupied habitat, but is not likely to have direct impacts to fish and is expected to be beneficial to fish habitat.

Greater detail of fisheries resources and an analysis of potential effects to fish species and their habitat are contained in the Fisheries and Aquatic Habitat section later in this Chapter.

Cultural/Heritage Resources

The entire Black Hills Project area was analyzed for cultural resources. The Black Hills Project Cultural Resource survey located numerous new sites including both prehistoric and historic components. Additionally, previously known sites were monitored for site condition (Durant and Clayton 2010).

Currently, the cultural resources within the project area are in good condition. Conditions were not deemed excellent due to minor natural erosion and an increase in vegetation density and litter caused by 100 years of wildfire suppression; but visible signs of looting and effects of grazing were not detected. Current conditions of seven previously known sites and all of the newly recorded sites were determined by visual surface-only examination in the field.

Potential effects associated with the Black Hills Project would be avoided using the "flag and avoid" method in combination with good communication. Cultural site boundaries, incorporating a buffer (protective space) zone, would be flagged prior to project implementation and site locations would be shared with project leads. Underburning around cultural sites would be implemented following establishment of fire lines or other avoidance measures, such as special lighting patterns.

Monitoring would continue throughout the duration of the project activities. If cultural resources were discovered during the implementation of proposed activities, project activity would be stopped in the immediate area while a plan to mitigate the effects is formulated.

With implementation of resource protection measures described in Chapter 2, no direct, indirect, cumulative, irreversible, or irretrievable effects are expected on any cultural resource sites. More detailed information can be found in the Cultural and Heritage Resources section of this EA.

Road Access

Proposed road decommissioning and road closures could reduce motor vehicle access to some areas. Many of the roads proposed for closure or decommissioning have not been used regularly and are currently ingrown with trees and brush, making them impassable to motor vehicle traffic. Reducing open roads in the project area would increase opportunities for solitude and could lead to improved big game hunting opportunities.

Forested Vegetation

Existing Condition/Affected Environment

At low elevations the Black Hills Project area contains ponderosa pine and lodgepole pine stands, while higher elevations on and around Spodue Mountain contain mixed conifer stands consisting of ponderosa pine, white fir, sugar pine and an occasional western white pine. Smaller inclusions of aspen clones and juniper woodlands also exist in the project area.

With the advent of fire suppression and past timber management, forested stands have been dramatically altered. These stands were generally more open stands, maintained by frequent low intensity fire, where large ponderosa pine was the dominant species. The resulting stands are overstocked and the result is increased probability for stand replacing fires and stands that are at high risk to insect and disease. Should fire return to these ecosystems, it's likely to occur as high intensity, stand replacing fires.

History of Disturbances

John C. Fremont who explored the area in 1843 wrote that he came across timbered lands that were in a park-like or open condition. Most stands were single story and had late and old structural characteristics (Lower Sycan Watershed Analysis, 2005). Since then there have been three types of disturbances that have led to forest conditions we currently have today; fire suppression, grazing practices, and timber harvest.

Pre-European settlement, the primary disturbance was wildfire. In eastern Oregon the historic fire return period was somewhere between 8-15 years. Over a large portion of the area, ponderosa pine was maintained as the dominant species through the relatively frequent occurrence of wildfire. Under these conditions large ponderosa pine were allowed to grow into perpetuity and live for centuries. The basic stand structure was single story with large trees, however, clumps of small diameter trees and clumps of old trees did occur across the area. Other fire tolerant species occurring in this area include sugar pine. These conditions allowed for open stands with grasses and shrubs in the understory.

"On north slopes, in draws, or in other places where mixed with other species, the yellow-pine forests are usually denser, more brushy, and therefore harder to traverse." (Munger, 1917). Concentrations of white fir were also present in stands but concentrated on northerly aspects, creek bottoms or adjacent to rock outcrops where the spread of wildfire was difficult. Large old white fir were present among pine patches where fire was absent long enough for white fir to develop and become somewhat fire resistant. Fires occurring at this time were low severity, stand maintenance fires. Ponderosa pine and fire evolved with each other over time.

In the late 1800s and early 1900s grazing was the primary disturbance. Unlike grazing in today's environment, the activity was unregulated and stocking levels of cattle and sheep were triple what current ecosystems experience. These conditions made it difficult for grasses and forbs to exist and greatly reduced the top soil layer in lower elevations of the project area. With the absence of fine fuels, fire frequencies decreased dramatically. With bare soil present, natural regeneration of conifers was encouraged; initiating the development of white fir forests we currently see developing. When grown together white fir tends to tolerate high stand densities better than ponderosa pine, which generates high competitive pressures on the pine. Under such pressure ponderosa pine becomes susceptible to pine beetle attacks. Due to the shade tolerance of white fir the species has been able to displace and compete with pine on what were historically pine sites.

In the early part of the 20th century, fire suppression was instituted. Although the number of fire starts in any year was likely unchanged, the size of fires was reduced substantially because of grazing and effects of fire suppression. Even after grazing was regulated and excessive use no longer occurred, the white fir component of the forest that initiated was allowed to continue to develop through the acts of fire suppression. Throughout the first half of the 20th century, the forest was dominated by ponderosa pine, but the new fir understories increased stocking levels and produced closed canopies that precluded grass and shrub development. In addition, aspen clones, which had been maintained by periodic underburning began to progress toward senescence and conifer encroachment begin to hinder aspen development. Lodgepole pine with its tremendous seed source and lack of fire rapidly expanded its range into wetlands, lower elevation ponderosa pine stands, and meadows. This species continues to expand its range and create "dog hair thickets" where hundreds- thousands of trees exist to form a stand so thick it resembles dog hair.

In the last half of the 20th century, the primary disturbance was timber harvest and associated timber management treatments. Post World War II, overstory removals (approximately 5,682 acres in the Black Hills Project area) of large diameter ponderosa pine was the dominant prescription, which served to further accelerate the development of the white fir forest. The rate of ingrowth of white fir was probably the highest on northerly aspects and in riparian habitats. By the 1980's, clear cutting was more prevalent, with about 580 acres of the Black Hills Project area receiving this treatment. These openings were planted to ponderosa pine. Timber harvest invariably reduced the presence of large trees on the landscape and simplified stand structure generally to young single storied stands.

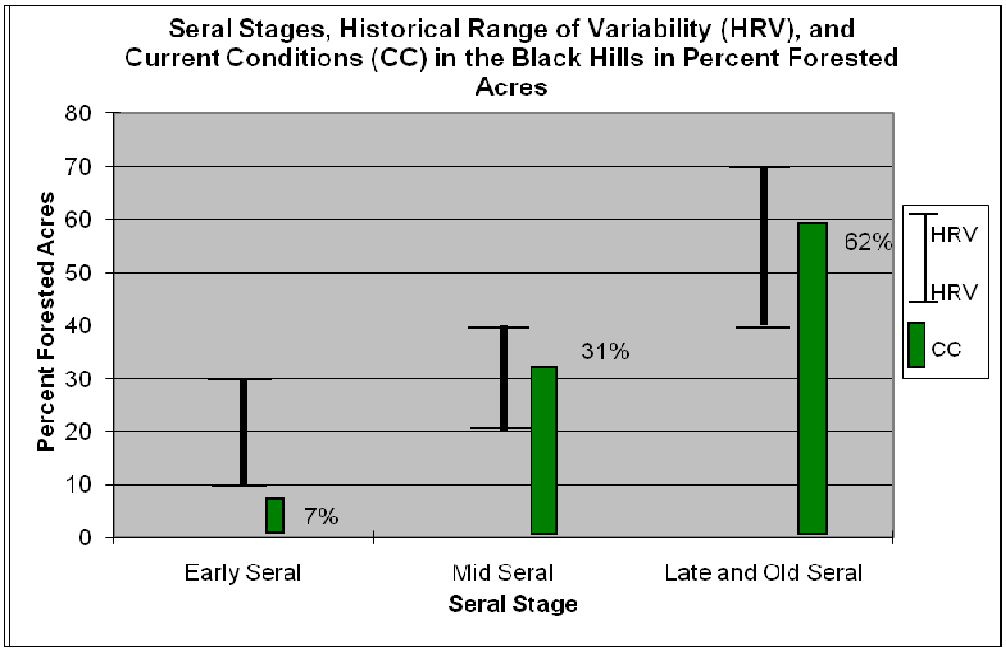
Existing Condition/Affected Environment

Current conditions present a high fire hazard because stand densities, accumulated natural fuels, brush densities and other components that contribute to fire intensity and spread are much greater now than under the historic fire regime. Wildfires currently burn at much higher severities, destroying a majority of the trees that used to survive frequent, low intensity fires. Stand growth rates and tree vigor are low due to heavy stocking and competition among species.

Vegetation was classified by seral stage and by canopy closure to determine the reference condition for the entire Fremont National forest. The Forested Plant Associations of the Oregon East Cascades was also used to determine potential vegetation (Simpson, 2007). These conditions reasonably represent the forests of this planning area. The definitions of seral stage used are the *Descriptions of Early, Mid, Late, and Very Late Seral Conditions for the Deschutes, Fremont, Ochoco, and Winema*

National Forests. Figure 3-1 displays how current conditions and reference conditions in the planning area compare.

Figure 3-1. Seral Stages, Historical Range of Variability (HRV), and Current Conditions (CC) in the Black Hills in Percent National Forested Acres.



**In reference data, Late and Old seral stages are combined.*

This graph provides a visual of the where the Black Hills Project area is in relation to seral stages. The Black Hills Project area contains one of the largest concentrations of late and old seral stages on the Bly and Lakeview districts. As shown, the project area is within HRV for the mid, late and old seral stages and below HRV for early seral stage. However, the late and old seral stages are split between late and old multi-story and late and old single-story.

Table 3-2. Canopy Closure, Reference and Current Conditions in the Black Hills Project Area, Bly Ranger District, Klamath County, Oregon.

	Reference Condition	Current Condition	Current Condition
Canopy Closure %	% of Forested Acres	% of Forested Acres All Ownerships	% of Forested Acres National Forest
> 70%	1	0	0
56-70%	7	3	3
26-55%	31	92	92
< 26%	62	5	5

Table 3-2 compares canopy closures between reference and current conditions, where the effects of fire exclusion are clear. The most dramatic departure is in the less than 26% crown closure class which decreased from 62% of the area to only 5% of National Forest forested acres. Stands at these low crown closures are representative of stable, old to late succession stands of open, park like stands, dominated by large ponderosa pine historically found in the area and maintained by frequent

low intensity fires. In the class of 26-55% crown closure stands may be overstocked with respect to desired densities that allow for healthier stands of trees.
The most recent HRV analysis of the biophysical environment for this area can be found in the Interior Columbia Basin Ecosystem Project Scientific Assessment (ICBEMP) (Quigley and Arbelbide, 1997).

Table 3-3. Historical and Current Physiognomic types (ICBEMP) in the Black Hills Project Area, Bly Ranger District, Klamath County, Oregon

	Reference Condition	Current Condition	Current Condition
Physiognomic Type	Historical	Black Hills Planning Area	Black Hills National Forest Acres
Early-Seral Forest	6-10%	6%	7%
Mid-Seral Forest	14-35%	32%	31%
Late-Seral Multilayer Forest	12-15%	60%	60%
Late-Seral Single Layer Forest	53-80%	2%	2%

Table 3-3 shows there has been a distinct shift away from late succession single story stands. This stand structure is well below HRV. Conversely, late succession multilayer forest is well above HRV.

A Fire Excluded Ecosystem
Fire exclusion in this area has resulted in an increase in tree density across most of the planning area. Stand densities have reached levels that put individual trees under high competitive stress. This stress results in increased susceptibility to pathogens and insects such as bark beetles. Currently, it is evident that mortality rates from bark beetles are increasing particularly in lodgepole pine and ponderosa pine. Of most concern are stands that have old trees remaining in them, particularly ponderosa pine. On many areas white fir and lodgepole pine are crowding ponderosa pine out of the stand. Under normal fire return intervals exhibited in the past, white fir and lodgepole pine component would have been thinned and controlled by periodic low-moderate intensity fires.

An additional feature of the increase in tree stocking is the creation of a continuous vertical fuel structure, increased crown bulk density, as well as increased surface dead fuel loadings, all leading to continuous conditions where crown fires are more likely.

These characteristics are generally the same as found in other recent analyses. A very small percentage of the Black Hills project area has experienced fire in the past 100 years. As a result, stands remain at too high a density from a forest health stand point and remain at high risk for insect and disease. Previous treatments were more conservative, leaving densities that were intended to maximize wood production rather than improve overall forest health. The surface and ladder fuels present make a crown fire more likely to initiate and higher densities would likely sustain a crown fire.

Taking these factors into account, one of the greatest risks in this area is the potential to lose a great number of the more fire resistant, large diameter ponderosa pine. At risk also is an important

component of sugar pine in the overstory and understory located on and surrounding Spodue Mountain.

Current State of Insect and Disease Activity

Insects and disease can cause mortality, decrease growth, and turn aesthetically pleasing areas in our forest to areas of red foliage. Still, they are a part of the ecological system of forests and create openings of vegetative diversity for wildlife and provide for decomposition. A healthy forest is never completely free of disturbances such as insects and disease pathogens.

In the past, mortality was confined to large diameter ponderosa pine killed by Western pine beetle (*Dendroctonus brevicomis*) and mountain pine beetle (*Dendroctonus ponderosae*). The level of mountain pine beetle mortality in the Black Hills project area can be described as endemic. However, there is a potential for levels to increase due to high stand densities (Eglitis, 2008). Ponderosa pine is characterized by having plentiful resin which acts as a defense mechanism against mountain and/or western pine beetle. The species also has a thick bark which allows it to withstand fire (Pelt, 2008). Over the past five years there has been a marked increase in insect related mortality particularly in the mid diameter lodgepole and ponderosa pine. Field reconnaissance has shown that approximately 90% of mortality in the last 3 years has been from mountain pine beetle. Currently, mortality is mostly occurring in lodgepole pine due to dense stands and stands being the age and size that lodgepole is most susceptible to mountain pine beetle, - which is 8-10 inches DBH and/or 100 years old.

Other insect and disease affecting forest health in the project area are western gall rust *(Endocronartium harknessii*) in Lodgepole pine, and red turpentine beetle (*Dendroctonus valens*) in the large diameter (>21 inches) ponderosa pine, which are at endemic levels. Dwarf mistletoe is common in the project area and has expanded in the area due to forest structure changing from single story to multi-layer structure. In the past, periodic wildfire events would prune mistletoe brooms that were low to the ground. Fir engraver (*Scolytus ventralis*) beetles are active on Spodue Mountain, primarily secondary to trees killed by root rot. Entomologists now believe there is a correlation between drought and fir engraver attacks. In drought conditions there seems to be an increase in fir engraver induced mortality. Stands at extreme risk of fir engraver activity are those that receive less than 25 inches of mean annual precipitation (Cochran, 1998). Generally, fir engraver attacks are secondary to root rot infection or other stressors, and do not seem to hit the large older trees as heavily. During droughts, the attacks become more severe and random, with quite vigorous trees being killed. Annosus root disease (*Fomes annosus*) has also been identified in pockets throughout the area in both pine and white fir stands.

The Fremont-Winema National Forest recently issued new direction regarding the application of borax to help prevent the spread of annosus root disease (Lerum, 2010). Guidelines are as follows:

> On all xeric pine plant associations. Apply borax as a preventative measure (within 24 hours of cutting) to all cut pine stumps greater than 12 inches in diameter, and to all other conifer stumps (with the exception of Douglas-fir, incense cedar and juniper) with a diameter greater than 18 inches. This guidance applies when cutting live trees or trees that have been dead a year or less.

On all other plant associations. Apply Borax as a preventative measure (within 24 hours of cutting) to conifer stumps greater than 18 inches in diameter (with the exception of Douglas-fir, incense cedar and juniper). This guidance applies when cutting live trees or trees that have been dead a year or less.

The use of Borax (EPA registered brand name - Sporax) does not appear to harm terrestrial species or aquatic species (FHP, 2006).

Regional Forester's Eastside Forests Plan Amendment 2

The Regional Forester's Eastside Forests Plan Amendment 2, commonly known as the "Eastside Screens," requires a proposed timber sale area be characterized by its biophysical environments and compared to the Historic Range of Variability (HRV) of the biophysical environment. At issue in this planning area is the amount of late and old successional (LOS) forest. This classification is divided into two stand structures, Multi-Stratum with Large Trees (MSLT) and Single Stratum with Large Trees (SSLT). The next screen, Interim Wildlife Standard, has two scenarios; A and B based upon the two classifications MSLT and SSLT and how they compare to the HRV. The most recent HRV analysis of these components can be found in the Interior Columbia Basin Ecosystem Project Scientific Assessment (Quigley and Arbelbide, 1997).

For the Upper Klamath Ecological Reporting Unit, for the dry forest potential vegetation group (PVG), the historic range of variability and the current conditions in the planning area are shown below.

Table 3-4. Historic Range of Variability vs. Current Conditions for Late and Old Structural Components in the Black Hills Planning Area, Bly Ranger District, Klamath County, Oregon.

	MSLT	SSLT
HRV	12-15%	39-65%
Current Planning area conditions	60%	2%

The Black Hills Project area is within HRV in terms of total LOS, but is well above HRV with respect to MSLT, and well below HRV with respect to SSLT. Scenario A is in force when one or both of the LOS structural stages fall below HRV. Therefore, any harvest activity will be designed to comply with wildlife standards of Scenario A.

Desired Future Dynamics and Ecological Restoration

The overall goal of the Black Hills Project is ecological restoration. One aspect of restoration is the process of retaining old trees not only for ecological reasons but for social reasons as well. It is also the process of perpetuating old ponderosa pine along with replacement trees in a heterogenic fashion instead of homogenous across the landscape. Moore et al. (1999) describes that a key principle to ecological restoration is restoring all processes in the ecosystem being compatible with how the system evolved historically. This is similar to recommendations in the *Final Recovery Plan for the Northern Spotted Owl* (USFWS, 2008) for restoring eastside forests, as suggested in comments by Oregon Wild. With forests that coevolved with fire, such as ponderosa pine, it is important to try and re-introduce fire back into the ecosystem (Busse et al, 2009).

The consideration of vegetation management in the Black Hills planning area is not to go back to one condition in time, but to reference a time where the landscape was resilient when disturbances occurred. The Forest Plan (as amended by the Eastside Screens) provides standards, guidelines, and objectives, on enhancing late and old structural conditions and maintaining old growth. "*A Plan for the Klamath Tribes' Management of the Klamath Reservation Forest*" also provides good recommendations as to what the forest should look like and how it should function.

In response to scoping for the Black Hills Project, Oregon Wild suggested consideration of prescriptions developed as part of the collaborative Glaze Meadow project on the Sisters Ranger District. Tim Lillebo working with Sisters District and others developed prescription concepts for ponderosa pine restoration. Similar to the Black Hills Project, the goals of their prescription are to restore ecological and hydrological functions by returning forests to historic levels of old growth and restoring fire resiliency to allow for natural fires. Prescriptions for the Black Hills Project would aim to achieve a species mix, age class structure and spatial complexity similar to results that would be obtained through implementation of Lillebo's prescription concepts.

Silvicultural prescriptions would be based on the plant association guide and historical levels (Plant Associations of the Central Oregon Pumice Zone, 1988) and would incorporate features suggested by the Klamath Tribes' Management Plan. Thinning would be prescribed to move stand densities towards their lower range rather than to high. This would reduce individual tree risk to pine beetle attack (Cochran et.al., 1994).

Conservation of Old Trees

Long-term management goals for forest vegetation come from the Forest Plan, as amended by the Eastside Screens. These goals are similar and consistent with the desired conditions described in the Klamath Tribes' Management Plan. The goal is to restore and maintain structurally complex stands dominated by ponderosa pine, including a population of large old pine trees. Many times, ponderosa pine trees that are less than 21 inches DBH are old trees. When recognizing old trees one must not only consider diameter but also the characteristics of the tree. Pelt (2008) provides good descriptions of the characteristics of old trees. Some of those characteristics include: wide bark plates, orange-yellow color in the outer bark, deeply furrowed bark, and boles free of old branches. Due to some ponderosa pine being old but less than 21" DBH, the characteristics described above would be used to help identify old trees in the project area. Juniper exhibiting old growth characteristics will also be conserved. These are trees whose bark is thick and fibrous, with developed vertical furrows (Miller et al., 2007).

Environmental Consequences

Table 3-5 shows the percentage of acres that will be moved from late seral multilayer to late seral single layer by alternative. Treating old growth designated stands in Alternative 2 further moves the forest towards historical conditions and greatly decreases the amount of forested acres in the late seral multilayer physiognomic stand type. This is accomplished by prescription objectives aimed at promoting single story stands.

Table 3–5. Expected change in percentage of late seral multilayer and late seral single layer forest by alternative in the Black Hills Planning Area.

Physiognomic Type	Historical	National Forest Acres	National Forest Acres Post Treatment	National Forest Acres Post Treatment
		Alternative 1	Alternative 2	Alternative 3
Late Seral Multilayer Forest	12-15%	60%	17%	29%
Late Seral Single Layer Forest	53-80%	2%	45%	33%

Alternative 1 – No Action

No vegetation management takes place and trees would continue to struggle growing at high densities. Stand density measures such as basal area and trees per acre would continue to increase and stands would exhibit increased density dependent mortality just as some already are.

Lodgepole pine would continue to grow and become more susceptible to insect and disease. Medium to large trees that are already dead from mountain pine beetle would become snags and eventually fall creating high fuel loads. Saplings to pole size trees would eventually become susceptible to the mountain pine beetle and the cycle would continue. Ponderosa pine stands would also continue to become less vigorous due to lack of water, nutrients, and sunlight. Canopies would become more closed and seedling establishment would become more difficult due to the shade intolerant tendency of ponderosa pine. Mixed conifer stands would continue to grow thick with the shade tolerant species white fir in the understory. Mid to large white fir trees would continually compete with desirable species ponderosa pine and sugar pine.

Fire would further be excluded from the landscape inhibiting the growth of young bitterbrush, encouraging the spread of white fir, increasing canopy bulk density, increasing ladder fuels, and escalating the potential of a stand replacing fire.

Species like bitterbrush would continue to grow old and decadent which are less palatable to deer. Grasses and forbs would become less present on the landscape because of closed canopies.

Effects Common to Alternatives 2 and 3

Site Specific Forest Plan Amendment to Remove White Fir over 21" DBH

Portions of the Black Hills Project area would benefit from an amendment to the eastside screens that would allow for cutting and removing some white fir trees over 21 inches DBH. Fire suppression and timber harvest in the past has led to the establishment of white fir where historically it wasn't present. White fir is a species that can be relatively young <150 years and large in diameter. In some cases, young-mature white fir over 21 inches DBH would be cut to enhance the growth and protection of ponderosa pine (Franklin et al., 2008). Cutting of young-mature white fir will further move the forest towards ecological restoration. In some cases large white fir is crowding out and competing with large ponderosa pine and act as ladder fuels (Franklin and Johnson, 2009).

This proposed Forest Plan Amendment is consistent with the requirements of the 2000 Forest Service planning regulations (36 CFR 219). Criteria in Forest Service Manual (FSM) 1926.52, Changes to the Land Management Plan that are Significant and 1926.51 for Changes to the Land Management Plan that are Not Significant provide direction for amending the Forest Plan.

The following examples indicate circumstances that may cause a significant change to a land management plan:

1 Changes that would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected (see section 219.10(e) of the planning regulations in effect before November 9, 2000 (see 36 CFR parts 200 to 299, revised as of July 1, 2000)).

2 Changes that may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area during the planning period.

Changes that would significantly alter the long-term relationship between levels of multiple-use goods and services originally projected (see section 219.10(e) of the planning regulations in effect before November 9, 2000 (see 36 CFR parts 200 to 299, revised as of July 1, 2000)). This amendment is limited in scope and does not in any measurable way alter the levels of multiple-use goods and services originally projected by the Forest Plan.

Changes that may have an important effect on the entire land management plan or affect land and resources throughout a large portion of the planning area during the planning period. The amendment is limited to the site-specific situation on up to 8,600 acres in the Black Hills Project area and would not be a significant change.

This amendment is being proposed specific to the Black Hills Project in association with Forest Service policy found at FSM 1926.51. Changes to the Land Management Plan are considered not significant when:

1. Actions do not significantly alter the multiple-use goals and objectives for long-term land and resource management.
2. Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management.
3. Minor changes in standards and guidelines are proposed.
4. Opportunities for additional projects or activities that will contribute to achievement of the management prescription.

Actions do not significantly alter the multiple-use goals and objectives for long-term land and resource management. The amendment is limited to the site-specific situation in the Black Hills Project area and does not apply to future decisions of any other areas. It does not alter the multiple-use goals or objectives of the Forest Plan. The Regional Forester's Forest Plan Amendment 2 (Eastside Screens) modified the emphasis on timber production by directing that a balance be struck between Forest Plan objectives for timber production and maintenance of late and old seral structure.

This amendment is intended to compliment the other treatments proposed for the Black Hills Project, with the objective of improving LOS conditions and moving conditions in the area closer toward HRV.

Adjustments of management area boundaries or management prescriptions resulting from further on-site analysis when the adjustments do not cause significant changes in the multiple-use goals and objectives for long-term land and resource management. This amendment would not change any management boundaries or prescriptions.

Minor changes in standards and guidelines are proposed. This amendment proposes to change the standard and guideline of the Regional Forester's Eastside Forests Plan Amendment 2 that requires retention of live trees greater than 21 inches dbh. This change would apply to up to approximately 8,600 acres of pine associated stands that are proposed for thinning treatments and would result in cutting about two white fir trees per acre greater than 21 inches dbh.

Opportunities for additional projects or activities that will contribute to achievement of the management prescription. The amendment would apply only to the Black Hills Project; no other projects or activities would be affected by this amendment.

Small Tree Thinning
The reduction in small diameter trees (less than 12 inches in DBH) on about 300 acres in the project area would decrease stocking levels and increase the vigor of residual trees. These areas are currently at levels of too high of stocking and thinning them would decrease their susceptibility to insect and disease and decrease ladder fuels in thinned acres.

Juniper and Mountain Mahogany Treatments
Juniper has expanded its range into meadows and low elevation pine stands due to fire suppression. On 218 acres encroaching (non-old growth) juniper and other conifer species would be cut to allow for the mahogany component to re-establish itself in places where it has been overtopped and/or suppressed by conifers. This would provide for a suitable seed bed for new mahogany seed germination and allow existing plants space to release.

Aspen Restoration
Conifer species have been encroaching into aspen stands since the start of fire suppression. Removing encroaching conifers would allow for aspen clones to become less crowded, which would provide for growth of small trees. Aspen restoration activities would ensure the existence of small, medium, and large aspen trees and allow existing clones to expand their range where they historically occurred. A healthy aspen stand resembles a bell shaped curve with small trees on the outskirts of the clone and medium-large trees inside the clone. Treatments would help move existing aspen clones toward this type of condition.

Considering Climate Change
The average warming rate in the Pacific Northwest over the next 50 years is expected to increase 0.2-1.0 ˚F per decade. Temperatures are expected to be warmer especially in the summer and more precipitation will be in the form of rain instead of snow (Mote et al. 2008). When combining warming temperatures and prolonged drought conditions, trees will continue to be stressed for water.

When a tree is stressed due to lack of water from drought conditions it leads to greater susceptibility to biotic agents. Climate change may also inhibit other forest entities to thrive, such as plantations, due to inability to adapt to extreme climate events (Innes and Peterson, 2004).

Climate change is expected to increase the severity, size, and intensity of wildfires (Franklin and Johnson, 2009). Under Alternative 2 and 3, carbon storage in the forest would initially be reduced due to lower stand densities; however, in the long run carbon storage would be recovered from the carbon stored in large trees. Future emissions from wildfires may also be reduced with fuel reduction activities proposed in Alternatives 2 and 3.

The treatments proposed under Alternative 2 and 3 would serve to increase resiliency of forested stands, promoting vigorous trees that are more adaptable to changing climate and drought conditions.

The effects of proposed thinning on climate change include:

1) Reduction of smaller trees that do not store significant amounts of carbon
2) Promotion of large diameter trees which store more carbon then small trees
3) Reduction of future emission from wildfires due to fuel reduction activities in Alternatives 2 and 3

With climate change increasing the risk of a large scale fire, the need for treatment becomes increasingly important. An intense wildfire would consume most trees due to existing ladder fuels and stand densities. Regeneration after a crown fire is difficult in ponderosa pine forest types, which historically experienced frequent low intensity fire regimes. Carbon loss in this situation can be up to 50%. Lodgepole pine, a prolific seeder, has reliable regeneration after a disturbance and can somewhat balance carbon loss by regrowth (Furniss et al., 2009).

The fuel reduction activities included in Alternative 2 and 3 (combination of thinning and prescribed fire treatment) would reduce the likelihood of an intense crown fire under expected climate change conditions.

Alternative 2 – Proposed Action

Thinning would increase the vigor of individual trees which would increase the overall health of stands. Initially grasses, forbs, and shrubs, would increase and in some cases re-establish themselves where they have been excluded due to lack of sunlight. Reduced tree densities would increase the amount of water, nutrients, and sunlight for individual trees. Creating gaps in the canopy would provide for seedling establishment particularly for ponderosa pine. Species composition would shift to more ponderosa pine rather than white fir or lodgepole pine. Water yield would eventually increase due to decreased number of trees across the landscape. Ladder fuels would decrease as well as height to live crown for individual species. The occurrence of insect and disease pathogens would likely stay at endemic levels due to healthier trees. Moist lodgepole stands are common next to meadows and in some cases were areas where aspen stands dominated. Therefore, an increase in grasses, forbs, and aspen suckers can be expected after thinning. Some areas of moist lodgepole may be burned 2-5 years post thinning to further hinder the occurrence of lodgepole pine in these areas and promote aspen regeneration.

About 2,600 acres on and around Spodue Mountain are not feasible for ground-based logging (generally >30% slope), however, these stands would also benefit from thinning treatment. Thinning in these areas utilizing helicopter logging systems would basically lead to effects very similar to those described above in regard to forest conditions.

Alternative 3

An alternative to the helicopter logging of Alternative 2 would be to harvest trees in a series of 300 foot corridors along roads on and around Spodue Mountain (about 740 acres) with ground-based logging systems. This would allow some thinning to occur on the mountain basically creating fuel breaks along road corridors. The remaining forested stands on Spodue would be treated primarily through prescribed fire. A broadcast burn implemented in a mosaic pattern across the landscape would target the killing of small to medium size white fir, some mortality in ponderosa pine, and slowly promote old growth conditions. The overall health of forested stands on the mountain would increase but not as much as it would under the actions of Alternative 2. Along the road corridors designated for treatment stand densities would decrease but not enough to make a difference across the landscape. Thinning here is primarily to provide for fuel breaks and safe travel routes. Prescribed fire on the mountain would kill small trees, but may also result in unpredicted mortality.

Under this alternative there would be no Forest Plan amendment to allow for thinning treatment of allocated old growth (MA 3 and MA 14). These stands would continue struggling for resources and be at risk to insects such as mountain pine beetle and stand replacing wildfires due to increased tree densities and ladder fuels.

Cumulative Effects

The effects of past fire suppression, selective harvesting, and livestock grazing have led to the forest we see in the Black Hills Project area today as described earlier. The actions included in Alternatives 2 or 3 would reduce the risk of stand replacing wildfires and insect and disease losses, increase stand health, and improve forage conditions while moving the landscape towards sustainable conditions. Ongoing actions including low levels of road related recreation and dispersed camping and hunting would not impact forested vegetation. Ongoing livestock grazing is not expected to impact forested vegetation, except perhaps aspen stands. Livestock impacts to aspen stands would be minimized by a treatment design feature that would retain portions of cut trees on site to protect new aspen sprouts from browsing. Ongoing firewood cutting results in the removal of dead trees, primarily those directly adjacent to existing roads. The quantity of dead trees removed for personal use firewood is minimal in the scheme of forested vegetation in the planning area. There are no reasonably foreseeable future projects expected in the next 5 to 10 years in the planning area. There would not be any cumulative effects to forested vegetation as a result of implementing Alternative 2 or 3.

Fire/Fuels

Existing Condition/Affected Environment

Fuels Conditions

The Black Hills Project area generally consists of fire adapted forest and shrub dominated vegetation types. Predominant forested plant associations in the Black Hills include ponderosa pine series and lodgepole pine series (Simpson 2007).

The ponderosa pine dominated stands in the Black Hills historically experienced frequent, low intensity surface fires (5-15 year mean fire return interval; Franklin and Dyrness 1988, Fitzgerald 2005). This fire frequency and behavior is classified as Fire Regime Condition Class (FRCC) Fire Regime 1 (0-35 year frequency and low to mixed severity; FRCC 2010). Many old growth ponderosa pine trees still exist in the Black Hills, but large amounts of ingrowth has occurred in these stands and is frequently visible as a distinct younger cohort. FRCC Fire Regime 1 areas also include what are currently ponderosa pine/bitterbrush associations. The large, old ponderosa pine trees in these areas support the conclusion that historic vegetation of the Black Hills was composed of well-spaced fire tolerant tree species (predominately ponderosa pine) with understory species of grass and small shrubs, well described by Society of American Foresters (SAF) cover type 237 - Interior ponderosa pine. Frequent, low intensity fires maintained open stand structures and sparse, light ground fuels by killing understory vegetation such as shrubs, small trees, and seedlings and consuming ground fuels (Hessburg et al. 2005). Frequent fires also kept thin barked tree species, such as white fir and lodgepole pine in low abundance, or limited to areas where fires occur less frequently (Fitzgerald 2005; Simpson 2007). The areas in the Black Hills that supported frequent, low intensity fires and contained open canopy ponderosa pine dominated forests have been described as the rarest type of old growth in the region, and should be the highest priority for fuels reduction and restoration (Hessburg et al. 2005, Simpson 2007).

Other dominant vegetation types of the Black Hills are classified as Fire Regime Condition Class Fire Regime 1, such as non-forest shrub and scabland communities dominated by mountain big sagebrush, antelope bitterbrush, mountain mahogany and herbaceous vegetation. These shrub lands transition into woodlands as scattered ponderosa pine, lodgepole pine, and/or western juniper trees increase in abundance.

The areas classified as Fire Regime Condition Class 3 (35-200 year fire frequency, and mixed severity; Agee 1993) in the Black Hills occur on higher elevation and north facing sites that contain white fir and sugar pine. Summer moisture is more abundant in these areas, contributing to longer historic fire-free intervals and increased site productivity than FRCC Fire Regime 1 areas. The greater productivity and amount of time between fires, compared with FRCC Fire Regime 1 areas, allowed fuels to accumulate and fire intensity and severity to increase at a faster rate than FRCC 1 areas. Fire Regime 3 also occurs in lowland areas that have a high water table, and are dominated by quaking aspen and lodgepole pine.

In the FRCC Fire Regime 3 areas of the Black Hills, historic fire behavior varied from low intensity surface fires to small stand replacement events, creating varying sized patches by killing differing

amounts of the above ground portion of the vegetation. Stand replacement events occurred in these areas during periods of exceptional and extended drought.

Current Fuels Condition

Contemporary fuels conditions differ from that of historical in two primary measures: fuel loading, and fuel type (Agee 1993, Brown 1994, Johnson et al. 2008). Compared with historical conditions, current fuel loadings are substantially higher (Fitzgerald 2005, Hessburg et al. 2005). Fuel loading is a primary factor contributing to uncharacteristically intense fire behavior and detrimental effects on vegetation. Increased fuel loading significantly increases tree mortality (severity) through increased fire intensity and burn duration. Current fuel types are composed of an increased amount of small trees and woody vegetation. For example, nearly all of the ponderosa pine stands in the Black Hills Project area currently contain an increased abundance of understory plants than they did historically. The increase in density and size of understory plants, especially woody vegetation has transitioned these stands from historical conditions that were best classified as a Fire Behavior Fuel Model 9 (long-needle conifer litter; Anderson 1982) to currently Fuel Model 165 (Very High Load, Dry Climate Timber-Shrub; Scott and Burgan 2005). This increase in fuel loading and the resulting transition in Fuel Models increase the negative effects on the ecosystem caused by wildfire. Current fuel arrangement also differs from historic conditions, because fuel depth and continuity have increased, increasing fire intensity, and connecting a higher proportion of the landscape, therefore increasing wildfire size, extent, and complexity of fire management efforts.

The primary cause of the current elevated fuel loading is fire suppression practices (Arno and Brown 1991). Effective fire suppression in the area began in the 1920's, and allowed forests to accrete fuels and understory vegetation.

Other land use practices, such as timber management and livestock grazing have also altered the fuels structures and therefore the fire behavior and fire effects in these areas. Previous timber management did occur in the planning area and these treatments removed some large overstory pines. The removal of overstory pines opened the canopy and understory vegetation responded to the increase in available growing space by increasing in density and size. Changes in vegetation include elevated stocking levels of fire intolerant species, decreased ponderosa pine dominance, increased abundance of shade tolerant species in the intermediate and lower canopy stratum, increased shrub component and fewer horizontal openings and structural heterogeneity associated with historic stands. Surface fuels such as needle litter, dead branches and brush that once were frequently consumed by light surface fires have now accumulated to amounts that seldom occurred historically.

Past management activities have altered stand structure, composition, and fire occurrence patterns. In the Black Hills, timber harvest, fire suppression, and livestock grazing have shaped the current stands and interrupted disturbance processes such as fire. For example, current ponderosa pine stands in the Black Hills are overstocked and multi-storied, with few examples of the historic open, fire-maintained stand conditions remaining. Current stands contain more small trees, and fewer large trees than existed in the past, increasing the amount of ladder fuels. Current tree growth rates are slow, and stand vigor is declining as competition for water, nutrients, and growing space has increased as a result of higher tree density. The decreased growth rates and low level of tree and

stand vigor makes trees more susceptible to insect attack and disease mortality, and makes trees less likely to survive a wildfire.

In each of the vegetation types described, forest fuels have accumulated from plant senescence and plant mortality. Dry climatic conditions and slow decomposition rates have resulted in large accumulations of burnable materials. Shrub species have become thick and decadent, with a large component of dead stems. The increasing decadence of shrubs is of concern because bitterbrush is an important browse species for mule deer in the area, and the majority of bitterbrush is currently in a mature to overmature condition. Multiple studies have found that when fire is excluded from ponderosa pine stands, over time antelope bitterbrush becomes decadent and palatability decreases (Arno and Ottmar 1994; Laudenslayer et al. 1989).

Vegetation in the shrublands of the Black Hills has increased in density, and dominant cover type. Ponderosa pine, lodgepole pine and western juniper trees have increased in range, currently occupying areas formerly dominated by sage, bitterbrush, and mountain mahogany.

Current Fire Risk and Fire Hazard

Two primary factors are involved when assessing the threat of wildland fire; fire risk and fire hazard. Fire risk is the probability that a fire will occur. It is often obtained through fire history analysis and the number of fires that have occurred in the vicinity of the project area). Fire hazard is determined by the fuel, topographic, and weather conditions that affect fire spread, intensity, and severity. Fuels include all of the live and dead vegetation present that would be consumed by a wildfire; examples are needle litter, brush, and trees. Of the factors contributing to fire behavior and fire effects, the forest fuels are the only parameter that can be directly manipulated to alter a wildfires rate of spread, intensity, and severity. Fire hazard can be estimated through fire behavior and fire effects modeling and by examining nearby fires that have occurred in similar fuel types.

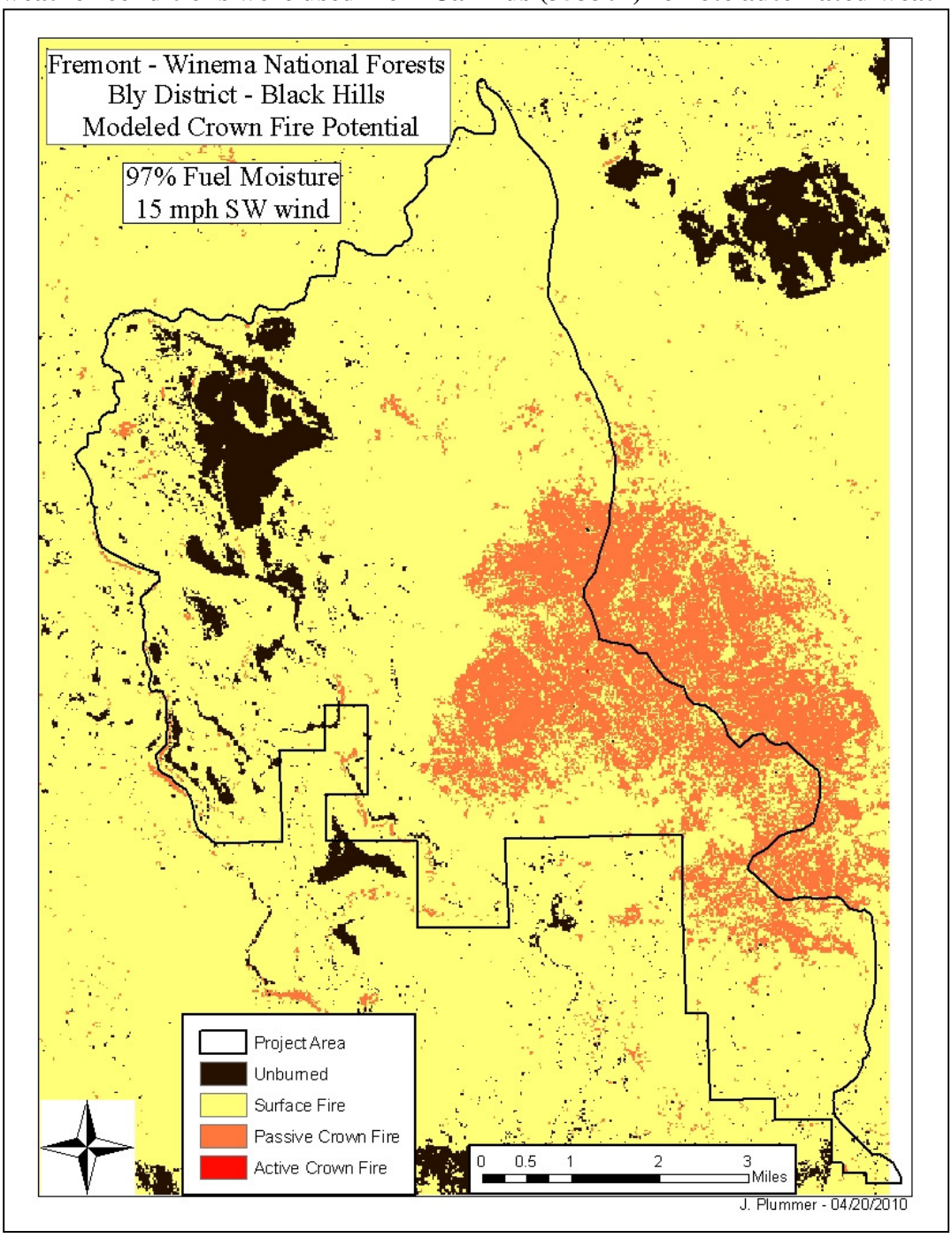
Recent fire history of the Fremont –Winema National Forests indicates a high probability of large fire occurrence in the Black Hills Area. The Lone Pine and Robinson Springs fires of 1992 and the Silver, Winter, and Toolbox fires of 2002, all occurred within 25 miles of the Black Hills Project area. These fires exhibited high severity fire behavior on a majority of the acres burned. Also, the 200 acre Biggin Fire in 1992 started within Black Hills and demonstrated the high intensity and severity that dry season fires burn under current fuels conditions (>50% high severity) in the project area. Also, the Lone Pine fire of 1992 was less than 5 miles from the Black Hills project area. The Lone Pine fire burned with high intensity and severity killing the majority of large overstory ponderosa pine, and burning 29,722 acres before it was controlled. The fuels treatments proposed in the Black Hills Project are targeted at preventing high intensity wildfire and improving fire management options. Brown et al. 1994 summarized fire risk in other dry, forested ecosystems similar to the Black Hills as "wildfire inevitably returns to fire prone ecosystems". In general, across the western United States, recent studies have found that wildfires are getting more severe (Miller 2009), indicating that preparation before a fire occurs may become increasingly valuable. Future climate scenarios suggest a continued increase in fire danger across the United States (Flannigan, Stocks, and Wotton, 2000; Bachelet et al., 2001; Brown, Hall, and Westerling, 2004; Mckenzie et al., 2004; Running, 2006) through increasing fire season length, potential size of fires, and areas vulnerable to fire, as well as by altering vegetation, which in turn will influence fuel loadings and consequently fire behavior.

Fire Behavior

Human influence and the accumulation of fuels has transitioned the fuel structures of these stands from a Fire Behavior Fuel Model 9 (FBFM; Anderson 1982) to conditions best described by Fuel Model 165 (Scott and Burgan 2005), increasing fire intensity and the negative effects on key ecosystem components. In the event of a wildfire, the current fuels and stand conditions will alter fire behavior and increase negative effects on key ecosystem components (Vaillant 2009). To estimate the effects of this change in fuel conditions, fire intensity was modeled using BehavePlus 4.0. BehavePlus 4.0 is a non-spatial "Windows software application to predict wildland fire behavior for fire management purposes" (Fire.org). Modeled wildfire intensity was 62 times greater under the current Fuel Model 165 than historical conditions characterized by Fuel Model 9 under the same weather (90^{th} – 97^{th} percentile fuels moistures, 5 mph upslope midflame wind speed, 80 degree Fahrenheit air temperature) and topographic conditions (0% slope). Modeled scorch height increased from 1 to 75 feet. The fire intensity and effects on vegetation (scorch height) generated from Fuel Model 165 during 90^{th} – 97^{th} percentile fuel moisture conditions will most likely kill the majority of overstory trees. Proposed fuels reduction treatments are aimed at promoting historic stand and fuel conditions that will produce fire behavior similar to that of Fuel Model 9.

Fire behavior modeling of the current fuel and forest conditions in the Black Hills was conducted to demonstrate the potential for loss of key ecosystem components (Figure 3-2). Fire behavior was modeled using FlamMap 3.0, with fuels and landscape data from Landfire (http://landfire.cr.usgs.gov/viewer/). Weather and fuel moisture conditions were summarized from the Calimus Remote Automated Weather Station (RAWS; 353307), and modeled at the 90-97^{th} percentile weather conditions. Twenty foot winds were held constant at 15 miles per hour, which is reduced to a light wind at mid-flame height due to dense forest cover.

Figure 3-2. Modeled Fire Behavior of Black Hills Project Area and Vicinity. 90-97th percentile weather conditions were used from Calimus (353307) remote automated weather station.



Although these fire behavior estimates show a considerable area is at risk for high intensity fire behavior (Figure 3-2), they are considered conservative estimates by Fire Managers. These estimates of fire behavior are considered conservative because of the averaging of fuel structures, the underestimation of ladder fuels and the overestimation of canopy base height. Although this

modeled fire behavior may underestimate the potential fire behavior it aids in the prioritization of treatments and locates areas where the highest potential for crown fire behavior exists. The areas modeled to burn with Passive or Active Crown Fire Behavior are predicted to have high mortality of overstory trees and may experience long-term negative impacts to the soil due to the great amount of heat received.

Fire was the primary disturbance that historically shaped the vegetation of the Black Hills. The recent removal of fire through fire suppression has caused the vegetation to diverge from historic conditions, toward that of a non-fire disturbance system. Evidence of this divergence can been seen in these stands as high stand density, and increased abundance of less fire tolerant tree species such as white fir and lodgepole pine

Environmental Consequences

Alternative 1 – No Action

The No Action Alternative retains the high tree density, high fuel loadings and risk of damage to values in the Black Hills Project area. The current fuels situation (described above) and the resulting fire behavior would continue to increase as would the probability of damage to the values at risk.

Effects Common to Alternatives 2 and 3

The Black Hills Project is part of a landscape-scale approach to forest restoration and fire hazard reduction. This effort is focused on areas currently rated as a high fire hazard and/or FRCC Condition Class 3. This project addresses the entire stand condition in treated areas, including reducing conifer stocking levels, ladder fuels, and accumulated wildland fuels. Fuels reduction efforts in the Black Hills are essential to minimizing damage to the forest, and maintaining the existing large/old trees.

The proposed activities effectively reduce fuel hazard and lower the condition class on 60-80% of the total project area. A majority of the remaining acres will remain in high fire hazard and Condition Class 3 and should be a priority for treatment after a maintenance condition is achieved on initially treated areas fuel treatments. When finished, the risk of uncharacteristically severe wildfires will be greatly reduced and the ability to manage wildfires for beneficial purposes within the project area will be enhanced because large continuous blocks of high fire hazard conditions are dissected.

Alternatives 2 and 3 may briefly elevate fuels and increase wildfire behavior during the period of time between thinning and prescribed burning.

The areas proposed for prescribed burning would benefit from reduced fuel loading, as well as restoration of fire as an ecosystem process. This process restoration has many implications and benefits for the ecosystem, such as nutrient cycling, balancing insect and disease populations, stimulating plant growth, and improving forage quality and nutritional value.

Recent research has shown that prescribed fire treatments can reduce the CO_2 emissions that would occur in the event of a wildfire. The stand types identified as having the most potential for reduction of wildfire CO_2 emissions include the two dominant forest types of the Black Hills Project area, dry mixed conifer, and ponderosa pine dominated stands (Wiedinmyer 2010). Prescribed burning in

Oregon's dry forest types was estimated to have the potential to reduce carbon emissions from wildfires by 57-64% (Wiedinmyer 2010).

The proposal to underburn approximately 25,000 acres of forest to maintain a Fire Regime Condition Class 1 (FRCC 1) condition would directly release CO_2 during the burning operation, which contributes to increasing the atmospheric greenhouse gas concentration. However, research indicates that restoration (or maintenance) of a FRCC 1 condition would result in a lower risk of uncharacteristically severe wildfire for those treated acres. This reduced risk has a two-fold effect on GHG emissions or the carbon cycle:

1) There is a direct beneficial effect on climate change of decreased GHG emissions from these acres because the risk of acres being burned by uncharacteristically severe wildfires would be reduced, and
2) There is an indirect beneficial effect by treating these acres because live stands of trees will retain higher capacity to sequester carbon dioxide compared to stands killed by uncharacteristically severe wildfires, especially if not immediately reforested.

Optimization and Prioritization of Treatments

Although the goal of this project is to reduce potential negative effects of wildfire in the majority of the project area (Agee and Skinner 2005), prioritizing key units for treatment can reduce the exposure of untreated units to wildfire in the interim. Prioritization of fuels treatments in the Black Hills Project area is based on modeled fire behavior and historic fire occurrence. Historical fire starts in the Black Hills most often occurred on the ponderosa pine dominated flats surrounding Spodue Mountain and near the peak of Spodue Mountain. Fire behavior modeling and expert opinion agree that the highest risk of crown fire behavior in the Black Hills is on the slopes of Spodue Mountain (Figure 3-2). Therefore, the top priority for fuel treatment is along the 3462 Road and in ponderosa pine dominated stands near the lower slopes of Spodue Mountain (Map Figure 2-3). Treating the fuels immediately surrounding Spodue Lookout Tower and Electronics site, is also of high priority. The location of these fuel treatments would moderate fire behavior and assist wildfire management efforts aimed at protecting Spodue Mountain from wildfires occurring on the flats surrounding the Mountain. The second priority for fuels treatments are the mixed conifer ponderosa pine and sugar pine dominated stands on the slopes of Spodue Mountain. Coupling prescribed fire with silvicultural treatments would create the greatest reduction in fire intensity and crown fire hazard. The third priority for treatment is the areas not included in the first two priorities, generally occurring on the flatlands surrounding Spodue Mountain.

Cutting white fir trees greater than 21 inches DBH

Where implemented, the removal of some larger white fir trees would reduce the likelihood of crown fire and damage to overstory trees, through reductions in canopy bulk density and canopy base height. White fir also possesses a crown shape and form that is less fire adapted and more conducive to supporting high intensity crown fire.

Thinning Treatments Common to Alternatives 2 and 3

Since many of the stands proposed for thinning have distinct cohorts, from a fuels perspective, thinning from below is an appropriate method of thinning in these stands. Thinning from below reduces ladder fuels more than other methods of thinning by creating separation between surface and crown fuels.

Small Tree Thinning (with and without extraction)
Small tree thinning accomplishes a number of benefits to the forest in regard to the intensity and severity of wildfire. The high density of small trees increases fire intensity and rate of spread. The cutting and removal of small trees that can produce biomass would reduce ladder fuels. The thinning and crushing of the smaller trees would also reduce the lower crown component that would move fire from the surface into crowns. Sustained crown fire in plantations would be reduced by the thinning of small trees and crushing of the fine fuels. Though the risk for a high intensity fire that would kill many of the remaining trees would exist for a season or two, winter snow would compact the fuel bed and lower the intensity of a surface fire such that the desired small diameter ponderosa pine would survive.

Treatment of Sycan Wild and Scenic River Corridor
Allowing fire to play its role in the Sycan Wild and Scenic River Corridor would reduce surface fuels, and limit the intensity and severity of future wildfires in the corridor. Limiting future fire severity in the Sycan Wild and Scenic River Corridor is important to maintaining the vegetation to prevent erosion and protect the aquatic resources of the Sycan Wild and Scenic River.

Alternative 2 – Proposed Action

Helicopter logging and prescribed burning of Spodue Mountain would result in large reductions in wildfire intensity, severity, and the potential for crown fire. Greater reductions in crown fuels and treatment extent on Spodue Mountain are major advantages of this alternative over the No Action Alternative and Alternative 3. This alternative has the greatest potential for reduction of surface fuels, canopy bulk density, and crown base height.

Negative impacts from fuels treatments would be minimized, but may infrequently occur. Potential impacts include low amounts of overstory mortality from prescribed burning scattered across the burn units. The amount of fireline constructed would be minimized, and minimum impact suppression tactics (MIST) would be employed.

Alternative 3

Alternative 3 differs from Alternative 2 in that no thinning and helicopter yarding in steep areas on and around Spodue is planned, nor would thinning treatment occur in designated old-growth stands (MA 3 and MA 14). Alternative 3 would not reduce potential wildfire behavior or severity as effectively in the steep areas on and around Spodue Mountain because ladder fuels and canopy bulk density would remain high. Several entries of prescribed fire treatment would be needed to reduce fuels to acceptable levels and bring about desired stand conditions. Old growth stands would remain at risk to losses from wildfire, as thinning from below would not be conducted in these stands.

Alternative 3 is however, a valuable treatment and would reduce the fuels and wildfire behavior in strategic locations to the extent possible using ground based equipment and without entering designated old growth areas. By focusing fuel treatments on the existing roads of Spodue Mountain, Alternative 3 would dissect contiguous blocks of fuel, increase firefighter and public safety along roads, and increase the number of wildfire management options.

Negative impacts from prescribed fire treatments would be minimized, yet may infrequently occur. Potential impacts include low amounts of overstory mortality from prescribed burning scattered across the burn units. The amount of fireline constructed would be minimized, and minimum impact suppression tactics (MIST) would be employed.

Cumulative Effects

In the Black Hills Project area past timber harvest, fire suppression, and livestock grazing have shaped the current stands and interrupted disturbance processes such as fire. Stand structure, composition, and fire occurrence patterns have been altered as described in the existing condition/affected environment section above. Proposed treatment with prescribed fire on private lands within the planning area would complement the treatments on National Forest System lands. The fuel treatments would moderate fire behavior and assist wildfire management efforts aimed at protecting private lands and homes. Ongoing actions including low levels of road related recreation and dispersed camping, hunting, firewood cutting and livestock grazing would not affect fuel levels or fire behavior to any measurable degree. There would not be any cumulative effects to fuels or fire behavior as a result of implementing either Alternative 2 or 3.

Air Quality/Smoke Management

Existing Condition/Affected Environment

For the purpose of maintaining air quality, the State Forester and the Department of Environmental Quality approved the Oregon Smoke Management Plan (477.013).

It is the policy of the State of Oregon (ORS 477.552):
(1) To improve the management of prescribed burning as a forest management and protection practice; and
(2) To minimize emissions from prescribed burning consistent with the air quality objectives of the federal Clean Air Act and the State of Oregon Clean Air Act Implementation Plan developed by the Department of Environmental Quality under ORS 468A.035. [1989 c.920 §2]

The objectives of the Oregon Smoke Management Plan are to:

A. Prevent smoke resulting from prescribed burning on forestlands from being carried to or accumulating in smoke sensitive receptor areas or other areas sensitive to smoke, and to provide maximum opportunity for essential forestland burning while minimizing emissions;
B. Coordinate with other state smoke management programs;
C. Comply with state and federal air quality and visibility requirements;
D. Protect public health; and
E. Promote the reduction of emissions by encouraging cost effective utilization of forestland biomass, alternatives to burning, and alternative burning practices.

Oregon Smoke Management Plan Information:
http://www.oregon.gov/ODF/FIRE/SMP/smokemgt_onthe_web.shtml

The airshed over and around the Black Hills analysis area currently falls outside any special protection zone due to its greater than 50-mile distance to the urban growth boundary of the city of

Lakeview and 40-mile distance from the city of Klamath Falls. The closest Class I Airshed-designated Wilderness Area is the Gearhart Wilderness, approximately 14 air miles east of the project area. Current regulations require compliance with the Oregon Smoke Management Plan (Oregon Smoke Management Annual Report, 2008).

Environmental Consequences

Alternative 1 – No Action

No treatment or activities are prescribed by Alternative 1. In the absence of fuel reduction treatments, the area is highly susceptible to a stand replacement fire. In the event of a wildfire, depending on fire size and intensity, air quality could be impaired for a three to four week period. The extent of effects on visibility and human health would likely be greater than effects from prescribed fire operations which would be managed to minimize effects to air quality.

Effects Common to Alternatives 2 and 3

Smoke emission estimates were generated using the smoke prediction feature in First Order Fire Effects Model (FOFEM) ver. 5.5. FOFEM is a computer program for predicting fuels consumption, vegetation mortality, soil heating and smoke emissions. For the purpose of analysis, it was assumed that the Proposed Action and Alternative 3 would be similar enough in treatments and area to use the same smoke emissions results.

Emissions presented here and measured in the field are reported in pounds per acre. Forest fuels are described in tons per acre.

Table 3-6. Emissions generated from prescribed burning fuels treatment (Rx Burn) and a wildfire with 50% crown consumption.

No Action Wildfire 50% Crown Consumption		**Prescribed Fire 10% Crown Consumption**	
PM 10 (lbs/acre)	PM 2.5 (lbs/acre)	PM 10 (lbs/acre)	PM 2.5 (lbs/acre)
631	534	235	200

Table 3-7. Emission Summary

	PM10 (lbs/acre)	**PM2.5 (lbs/acre)**	**CH4 (lbs/acre)**	**CO (lbs/acre)**	**CO2 (lbs/acre)**	**NOX (lbs/acre)**	**SO2 (lbs/acre)**
Wildfire (50% Crown Consumption)	306.0	260.0	149.0	3157.0	31451.0	34.0	21.0
Rx Burn (10% Crown Consumption)	165.0	140.0	80.0	1710.0	16505.0	17.0	11.0

The duration of smoke generated from the proposed prescribed burning would be short-term (from several days to 2 weeks, depending on weather conditions) and is expected to have a negligible effect on surrounding communities and Class I Wilderness areas, due to the location of the project area. Burning would be conducted during conditions that create effective mixing and dispersion of the smoke generated to the greatest extent possible.

All prescribed burning operations would be conducted with approval from the Oregon Department of Forestry to avoid smoke incursions into Bly, Lakeview, Klamath Falls and the Gearhart Wilderness and maintain compliance with the Clean Air Act and the Oregon State Implementation Plan.

Dust and vehicle emissions could temporarily reduce air quality in the immediate vicinity of equipment operations. All alternatives involving commercial removal would require the application of dust abatement to roads used for haul. Any impacts from dust and vehicle emissions would be short-term and temporary in nature.

This project would comply with the requirements of the Clean Air Act and be conducted in accordance with the operational guidelines agreed to by the USDA Forest Service and the Oregon Department of Environmental Quality. The project would meet the Forest Plan air quality standards, and management direction to "maintain existing air quality." The Forest participates in the Oregon Smoke Management Program to meet National and State air quality standards for PM 10 and PM 2.5. The project would meet all criteria to protect air quality and would not result in any long-term effects to air quality.

Cumulative Effects

Although the Fremont-Winema National Forest tries to conduct prescribed burning during periods of good or better smoke dispersion, there may still be some cumulative smoke impacts from concurrent private and forestry burning common to Alternatives 2 and 3. It is assumed that all burning would likely occur over a brief period of time while conditions are appropriate, and smoke monitoring would be implemented, thereby reducing the potential cumulative effects. Low levels of road related recreation use would not contribute to cumulative effects related to dust.

Hydrology and Soils

Existing Condition/Affected Environment

Hydrologic Location and Soil Type:

The Black Hills project area is located within the Sycan River, Snake River, and Marsh Reservoir 6th field subwatersheds, which are part of the lava tablelands found in the Basin and Range province. Annual precipitation ranges from 20 to 40 inches, most of which comes in the form of snow during the winter. The project area is located primarily within areas geologically described as Rhyolite Eruptive Centers and Basalt and Tuff Flows. Much of the soils are derived from wind-blown sandy ash deposited from the adjacent Western Cascade terrain over basement lava rocks (Wenzel, 1979). The predominate soil types (Table 3-8 and Figure 3-3) have loam or sandy loam texture, moderate to high infiltration rates when wetted, and are well drained (Wenzel, 1979).

Table 3-8. Soil types found in the project boundary as characterized by Wenzel (1979)

Soil Type[1]	Hydrology	Bedrock	Erosion Susceptibility	Compaction Susceptibility	Displacement Susceptibility	Percent of Area
84	B	7	Low	Low	High	17.6
77B	A	6	High	Low	Low	14.0
87	B	7	Low	Low	Moderate	13.7
78	A	6	High	Low	Moderate	13.1
28	D	3	High	High	High	11.6
77A	A	6	Low	Low	High	7.2
83	D	7	Moderate	Moderate	Moderate	4.8
82	B	7	Moderate	Moderate	High	3.5
85	B	7	Low	Low	Moderate	2.9
2	HV	1	Moderate	High	Moderate	2.4
81	C	7	High	Moderate	Low	1.7
64	B	5	Low	High	Moderate	1.5
13	D	2	High	High	Low	1.2
88A	B	7	Low	Low	High	1.1
850	Cmplx	Cmplx	Low	Low	High	1.0
10	A	1	High	Low	Low	0.7
53	D	5	High	Moderate	High	0.4
18	D	2	High	High	Low	0.4
88B	B	7	Low	Low	High	0.4
90	C	7	Moderate	High	High	0.2
6	HV	1	High	Moderate	Low	0.2
16	D	2	High	High	Moderate	0.1
56A	B	5	High	Moderate	Low	0.1

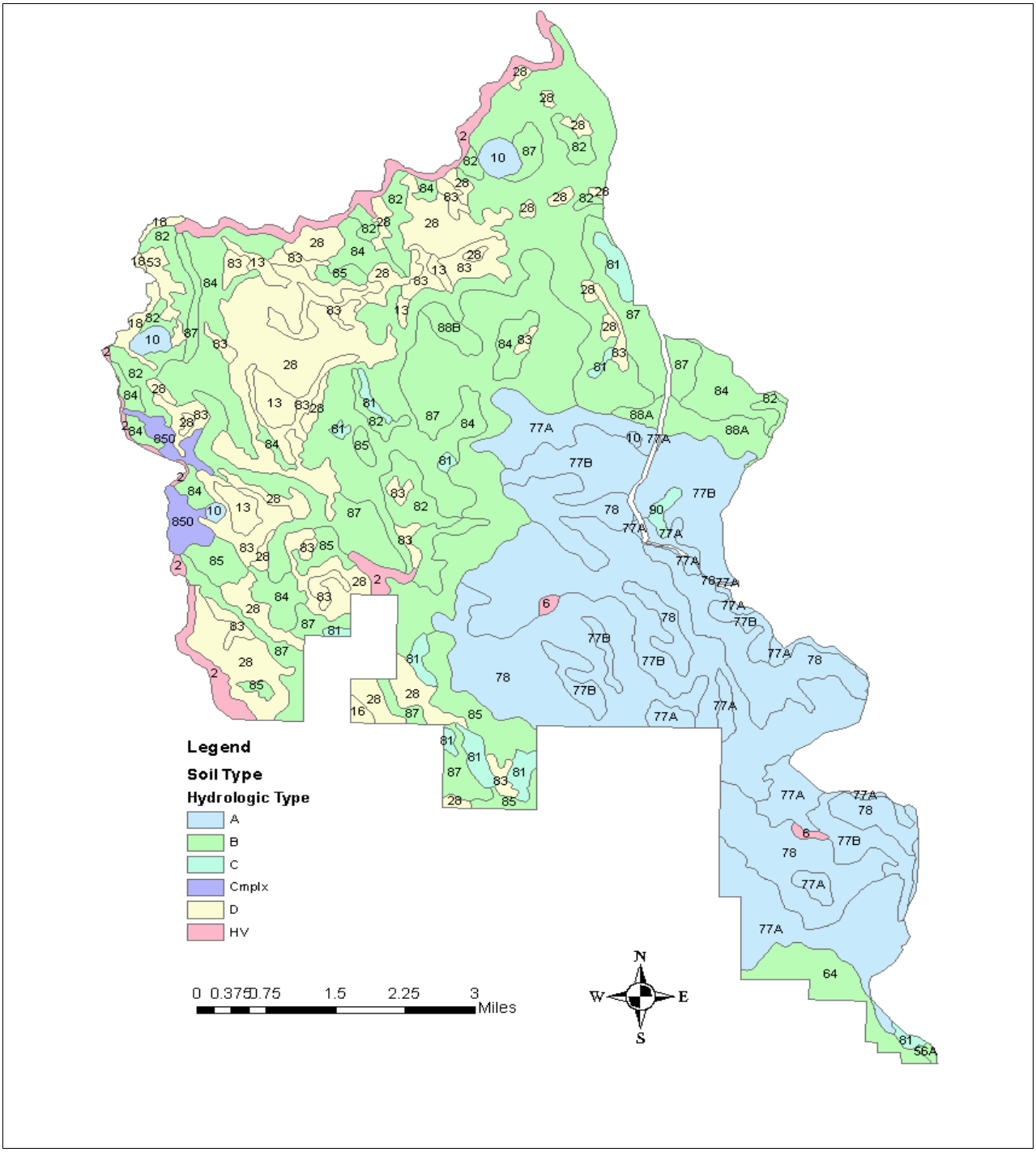
1 – Soil type descriptions are found in the Fremont National Forest Soil Resource Inventory (Wenzel 1979). Only those types comprising at least 0.5% of the project area are included in this table. Hydrologic capability, erosion susceptibility, and compaction susceptibility levels were taken from the Soil Resource Inventory.

Hydrologic Capability of Soils

The soils within the project area were divided into four hydrologic soil groups, which indicate the general infiltration and water movement ability of the soil and bedrock materials (Wenzel, 1979). Soils within hydrologic soil group A are deep, well to excessively drained sands and/or gravels that

have high water infiltration and transmission rates when thoroughly wetted. Hydrologic soil group B is characterized by soils that are deep to moderately deep, moderately well drained to well drained, have moderately fine to moderately coarse texture, and have moderate water infiltration and transmission rates. In general, soils within groups A and B have a low runoff potential. Hydrologic soil group C consists of (1) soils with a layer that impedes the downward movement of water; or (2) soils with moderately fine to fine texture and slow infiltration rates. The soils in hydrologic group C have slow water infiltration and transmission rates when wetted. Hydrologic soil group D consists of (1) clay soils with high swelling potential; (2) soils with high permanent water table; (3) soils with clay pan or clay layer at or near the surface; or (4) shallow soils over nearly impervious materials. Hydrologic soil group D is characterized by soils with very slow rates of water infiltration and transmission when wetted. In general, hydrologic soil groups C and D are likely to generate surface runoff. Within the Black Hills project area, hydrologic soil groups A and B comprise approximately 75% of the project area, indicating that the majority of the project area has soils with moderate to high water infiltration and transmission rates, and a low potential to generate surface runoff.

Figure 3-3. Soil types found in the project area.



Environmental Variables Potentially Affected

Compaction

Soil compaction occurs when soil pore space and soil bulk density decrease. Compacted soils can be identified by platy soil structures with horizontal alignment, as compared to healthier soils with three-dimensional alignment and blocky and granular structure. As the contiguity and prominence of platy structures increases, so does the severity of the compaction and degree of root growth restriction. Soil compaction can occur during timber harvest from the use of heavy logging equipment, increased use of existing roads, and construction of temporary roads. The degree of compaction is dependent upon operational practices and site conditions, and generally increases with increasing soil moisture (Ares et al., 2005; Moore and Wondzell, 2005). As soils become compacted, the amount of water that can infiltrate the soil is reduced (Elliot, 1999), which can increase surface runoff and erosion, and thus decrease groundwater recharge. However, freeze-thaw cycles and increased understory plant growth and root expansion can mitigate soil compaction caused during timber harvest (Castellano and Valone, 2007).

Approximately 72% of the soils within the Black Hills Project area have a low susceptibility to compaction (Table 3-8). The last major ground disturbing activities within the project area occurred during the late 1980s. To assess the impacts of these activities on soil resources, a field crew conducted soil surveys during July, 2009, following the methods in the *Field Soil Disturbance Protocol for Winema and Fremont National Forest* (USDA, 2002). Soil survey transects, approximately 400 meters in length, were stratified by general land type groupings, and laid out on a north (360º) compass bearing. On each transect, degree of soil compaction was quantified at approximately 20 locations spaced 20 meters apart (115 total locations). At each location, evidence of equipment and soil compaction within a 10 meter radius was recorded. A planting spade and ruler were used to quantify the extent of soil structure tilth or platy layers, plate depth, and thickness. The results were then classified into six disturbance classes (Table 3-9). Disturbance Classes 1 and 2 have slight to no disturbance, Classes 3 and 4 have moderate disturbance, and Classes 5 and 6 have detrimental disturbance. Disturbance classes 5 and 6 exceed standards imposed by Forest Service Region 6.

From the soil surveys, 87% of the sample locations had little to no soil disturbance, and only 1% exhibited detrimental soil disturbance (Table 3-9). At those locations with moderate or detrimental soil disturbance, evidence of naturally occurring processes that can mitigate soil compaction by converting platy soil structures to blocky structures was observed, indicating a high potential for recovery. These included surficial frost heave, shrub/graminoid root penetration, and wildlife interactions with the soil (badgers, squirrels, gophers, etc.). Additionally, a vigorous shrub component (primarily bitterbrush, *Purshia tridentata*) was observed. This type of vegetation in conjunction with the sandy loam soil texture found in most of the soils can facilitate rapid recovery from soil compaction.

Table 3-9. Summary of Soil Disturbance Survey Results

Disturbance Class		
Undisturbed to Slight	**Moderate**	**Detrimental**
100	14	1
87%	12%	1%

Erosion

Erosion in this section will be discussed in terms of soil surface erosion outside of stream channels (stream channel erosion is discussed in the upcoming Channel Morphology section). Soil erosion occurs as soil particles are detached and transported by wind and water. Wind erosion is minimal when compared to water erosion (fluvial erosion) in the project area (personal observation), and therefore only fluvial erosion will be discussed. During timber harvest, increased overland flow resulting from soil compaction can cause fluvial erosion. Removal of vegetation and organic residue during timber management increases the susceptibility of soil to transport by surface overland flow as well as to rain splash erosion (soil particle detachment due to rain drops). Fire can also lead to increased soil surface erosion by making the soils hydrophobic (water repellant), which can impede water infiltration (Letey, 2001) and increase overland flow. Soil hydrophobicity can be severe and long-lasting following high intensity fires, however, it is generally short lived following low intensity fires (such as those that are intended with prescribed fires) (DeBano, 2000). Surface erosion often occurs on forest roads due to channelized surface runoff with high velocity that can easily detach soil particles. While timber harvest and associated soil disturbances can lead to a short term increase in soil erosion, the increase in shrub and herbaceous ground cover that follows timber management generally leads to increased soil water infiltration. This in turn can decrease overland flow, which can lead to a long term decrease in soil erosion.

Approximately 43% of the soil within the project boundary is classified as having a high potential for erosion (Table 3-8). However, low gradient forested landscapes (less than 30% slopes) comprise approximately 87% of the project area. Low slopes, combined with low precipitation and porous soils indicate that widespread surface erosion is unlikely. Conversely, the road density on the National Forest lands within the project area is 5.41 miles per square mile, which more than doubles the Forest Plan's recommendation of 2.5 miles per square mile. Therefore, relatively high potential for erosion from roads does exist. Mass movement erosion, such as landslides and slumping, is not likely within the Black Hills project area due to relatively low soil moisture and low gradient slopes.

Encroachment by junipers (and other conifers) into meadows can also increase soil erosion. Junipers generally out-compete shrub and herbaceous vegetation for sunlight and nutrients, which can result in increased barren ground following juniper encroachment and higher soil erosion potential (Pierson et al., 2007; Peterson and Stringham, 2008; Pierson et al., 2010). The reduction in shrub and herbaceous ground cover also reduces the infiltration capacity of the soil, which further increases the potential for overland flow and surface erosion. Fire suppression within the Black Hills project area has resulted in juniper encroachment into meadows, and junipers are now established in areas where they were historically only a minor component of the landscape (Lower Sycan Watershed Analysis, 2005), which has increased the potential for soil erosion.

Displacement

Soil displacement is defined as the removal and horizontal movement of soil by mechanical forces (Fremont National Forest Land and Resource Management Plan, pg 80, 1989), which can result from the use of ground disturbing equipment during timber harvest (Scott, 2007). Soil displacement can concentrate water and damage soil structure, and lead to reduced infiltration and root growth, and increased erosion. Approximately 65% of the soil within the project boundary is classified as having a low to moderate potential for soil displacement (Wenzel, 1979).

Soil Productivity

Timber harvest can affect soil productivity due to soil compaction, erosion, soil displacement, and vegetation removal. For example, increased surface erosion following vegetation removal can remove or redistribute topsoil, which is the most fertile soil layer. Erosion of shallow soils and soil compaction can decrease the area of the root zone and the amount of air, water, and nutrients available to plants. Further, fires can volatilize nutrients that are necessary for plant growth. These impacts are interrelated (i.e. they affect and are affected by each other) (Elliot, 1999), and therefore, soil productivity for the Black Hills project area will not be discussed or analyzed separately in this document but rather will be addressed through analysis of the aforementioned factors.

Streamflow

The amount and timing of runoff is a function of the amount, timing, and intensity of precipitation, as well as the amount, type, and spatial distribution of vegetation in the watershed. Within the Black Hills project area, fire suppression over the last century has resulted in tree stands with a dense overstory and relatively low ground cover by shrub and herbaceous vegetation. These conditions have resulted in low soil water infiltration and increased overland flow, which has lowered the groundwater table, increased peak flows, and lowered base flows relative to historic levels (Lower Sycan Watershed Analysis, 2005). Fire suppression has also increased the possibility of large scale, high intensity wildfires, which can have negative short and long term consequences to both base and peak streamflows (Neary et al., 2005).

Logging can also cause both short and long term changes in streamflow (Moore and Wendzel, 2005; Scherer and Pike, 2003). For example, stream peak flows can initially increase following timber harvest. Here, soil compaction can decrease water infiltration and thus increase the amount of water traveling to the stream channel as overland flow (which increases peak flows during precipitation and snowmelt events). However, the increase in shrub and herbaceous ground cover that often follows timber management leads to long term increases in infiltration, reduced overland flow, and thus less extreme long term peak flows. The short term reduction in infiltration following timber management activities can also decrease the amount of water stored as groundwater, which can lead to short term decreases in baseflow. However, the reduction in canopy cover decreases the amount of snow intercepted by the canopy and lost to evaporation and sublimation (Storck et al., 2002; Stottlemyer and Troendle, 2001). Greater snow accumulation on the ground, coupled with long term increases in infiltration, generally increases groundwater storage and leads to higher and more sustained stream baseflows.

Timber harvest also impacts the amount of water leaving the system through transpiration, which can impact streamflow. The decrease in vegetation immediately following timber harvest can cause a short term decrease in transpiration, and an increase in streamflow. However, increased ground cover by shrub and herbaceous vegetation, as well as increased vigor in remaining trees, generally leads to negligible long term changes in transpiration (Kelliher et al., 1986).

As discussed in the section on erosion above, juniper encroachment has occurred within the project area, and densities are higher than historical values (Lower Sycan Watershed Analysis, 2005). The decrease in shrub and herbaceous vegetation following juniper encroachment can lead to reduced groundcover and lower soil water infiltration and storage (Pierson et al., 2007; Petersen et al., 2008). This reduction in ground cover can also lead to higher soil temperatures and therefore higher

evaporation (Breshears et al., 1998). The combination of decreased soil water infiltration and increased evaporation following juniper encroachment can reduce the amount of water in the soil and therefore the amount of water available to recharge groundwater and sustain baseflows. The reduction in infiltration that occurs with decreased shrub and herbaceous groundcover following juniper encroachment can also lead to higher peak streamflows due to increased overland flow.

Streamflow in the project area is predominately intermittent (combined distance of 30 miles). There are only 3 perennial streams located within the project area (combined distance of 6.8 miles). Blue Creek and Mill Creek are classified as perennial non-fish-bearing streams, and the Sycan River is the only fish-bearing perennial stream. The Sycan River is designated as a Wild and Scenic River for the portion that flows along the project boundary. The peak streamflows in the project area are primarily driven by spring snowmelt. Mill Creek and especially the Sycan River are responsive to snowmelt, having very distinct streamflow peaks followed by a rapid recession with very low summertime base flows. The summer baseflow in these streams is also driven by spring snowmelt, which recharges groundwater that ultimately feeds into the streams throughout the summer. In contrast, streamflow in Blue Creek appears to be driven by longer lasting more stable groundwater sources that produce a less pronounced hydrograph.

Channel Morphology

Stream channel morphology is defined by the cross sectional and longitudinal shape of the channel, and channel substrate size and distribution. Alterations in stream channel morphology can result from erosive high flows and changes in stream sediment delivery, both of which timber harvest and prescribed fire can affect. For example, decreased infiltration and increased overland flow following timber management can increase peak flows, which can increase streambank erosion. Timber management can also increase sediment delivery to the stream, as soil disturbance increases the likelihood for soil detachment during overland flow. Additionally, road networks used in the timber harvest operations can capture and concentrate shallow subsurface flow and increase channel networks, leading to increased sediment delivery to the stream channel (Foltz, 1995; Luce and Black, 1999). However, long term increases in soil water infiltration following timber management generally leads to decreased overland flow and peak flow, which can result in improvements in stream channel morphology.

Descriptive morphological characteristics such as width:depth ratios and stream bank stability are important for assessing channel stability and susceptibility to temperature fluctuations (see water quality section below for discussion on stream temperatures) (Bartholow, 2000, Lile et al., 1995). The Sycan River is the only stream in the project area that has had a Level II Habitat Survey. The results of that survey show that the Sycan River is generally very wide and shallow and has a substantial amount of pea gravel and fines. Six of the seven surveyed reaches had width:depth ratios that exceeded the INFISH riparian management objective of 10. However, banks along the Sycan River are generally stable, and all but one of the seven reaches exceeds the 80% riparian management objective set forth by INFISH. This indicates that the channel is not actively widening. The other streams within the project boundary typically had smaller width:depth ratios than the Sycan River and also had stable banks (based upon ocular observations). During field reconnaissance, it was observed that other streams in the Black Hills project area have a wide range of channel slopes and shapes as well as substrate sizes and distributions. Although not quantified,

ocular observations indicated that Blue Creek had few fines in the channel substrate while Mill Creek had a higher proportion of fines in the channel substrate.

Water Quality

Timber harvest can impact water quality parameters such as water temperature, water turbidity, and nutrient loading. For example, stream temperatures can increase due to the removal of vegetation that provided shade to the stream (Anderson et al., 2007; Northwest Forest Plan Temperature TMDL Implementation Strategies, 2005). Stream water turbidity and nutrient loading often increases following increased overland flow and associated sediment and particulate matter delivery to the streams. Further, increases in stream temperature and nutrient loading following timber harvest can lead to increased algal growth, as well as decreased dissolved oxygen, which is necessary to sustain fish populations (USDA Forest Service, Environmental Assessment and River Management Plan for the Sycan Wild and Scenic River, 1992).

Acceptable water quality parameters and levels for streams are set by the designated beneficial uses for their respective drainage basins. The Black Hills project area lies within the 4th field HUC Klamath Basin and therefore is lumped with all other basin waters that do not have unique beneficial uses assigned. In Oregon's 2004/2006 Report on water quality (ODEQ, 2006), the only waterbody in the Black Hills project listed in the database is the Sycan River. The Sycan River was previously listed on the 303(d) list (a list of waterbodies with impaired water quality) for exceeding summertime temperatures, and is currently recognized as needing increased data collection for nutrients and sedimentation. Because of its low summer time flows and high width:depth ratios, the Sycan River is naturally susceptible to high summertime water temperatures. Conversely, Blue Creek and Mill Creek are less susceptible to warmer temperatures because they have lower width:depth ratios (personal observation) and are more shaded. While it is not known what kind of nutrient loading Blue Creek and Mill Creek have, Mill Creek likely has high nutrient loading in certain reaches due to grazing and naturally high phosphorus levels. Because most of the flow for Blue Creek is from deeper groundwater and grazing impacts are lower, it is likely less susceptible to high nutrient loading. Likewise, turbidity induced by surrounding sediment and organic matter is likely greatest for Mill Creek and the Sycan River. Blue Creek has naturally high turbidity due to the lithology where the source groundwater has a longer residence time.

Environmental Consequences

Alternative 1 – No Action

Under Alternative 1, no treatments would occur. Uncharacteristically high fuel loads and their risk to creating large scale high intensity wildfires would remain (DeBano et al., 1998). If a high intensity wildfire were to occur, there would likely be negative environmental consequences in regards to hydrology and soils. For example, extreme heat from high intensity fires would consume soil organic layers, destroy soil structure, and cause high levels of soil hydrophobicity. This hydrophobicity, coupled with the decrease in plant ground cover and root networks, would decrease soil water infiltration and lead to increased surface erosion and sediment delivery to the stream, and decreased water quality. The groundwater table would likely decline and stream baseflows would decrease. Further, peak stream flows would increase and have higher velocity, which would lead to streambank erosion and degradation.

Juniper and other conifer encroachment into meadows would likely continue under Alternative 1, and the reduction in shrub and herbaceous ground cover would decrease soil water infiltration capacity. Decreased infiltration would further reduce summer baseflows. Retainment, and likely expansion, of encroaching pines would also sustain the risk of high severity burns adjacent to stream channels, which would further increase erosion and sediment delivery. The no action alternative would have no direct impact to stream water temperature. However, if a high severity burn were to occur adjacent to the creek, the loss of vegetation would lead to increased water temperatures.

Under Alternative 1, no roads would be closed or decommissioned. Roads would continue to channelize surface runoff and deliver water to the stream at a faster rate than would normally occur, and increased sediment delivery to the stream would continue. However, logging would not occur under Alternative 1, and short term (1-5 years) increases in erosion and sedimentation that would result from the construction of temporary roads and increased use of existing roads would not occur.

Alternative 2 – Proposed Action

Under Alternative 2, approximately 16,072 acres would be treated using ground-based logging equipment, and 2,644 acres would be treated using a helicopter logging system. Implementation of Alternative 2 would reduce the risk of catastrophic wildfire, the effects of which are described under Alternative 1.

With the implementation of Alternative 2, the density of overstocked forest stands within the project area would be reduced, and the amount of shrub and herbaceous ground cover would increase. Increased ground cover would facilitate soil water infiltration, and the net long term effects of Alternative 2 to soils and hydrology would be increased groundwater storage and summer base flows, and decreased peak flows, overland flow, erosion, and sediment delivery to the stream.

However, Alternative 2 would have some short term (1-5 years) negative impacts to soils and hydrology. For example, heavy logging equipment and the increased use of existing roads and the construction of temporary roads and skid trails would lead to a short term increases in soil compaction (Ares et al., 2005; Moore and Wondzell, 2005). This short term increase in soil compaction would decrease soil water infiltration and increase runoff, erosion, and stream sediment delivery. However, this compaction would likely not be widespread in the project area, as approximately 72% of the soils within the project area have a low susceptibility to compaction (Wendzel, 1979), and soil surveys during 2009 indicated that only 1% of the soils exhibited detrimental soil disturbance from past logging activities. In addition, the porous nature of the soils within the project area, coupled with frequent freeze-thaw cycles and increased shrub and herbaceous vegetative growth and root expansion, indicates that the soils would quickly recover from the compaction caused by logging activities. Resource protection measures would also limit the distance between treatment activities and perennial and intermittent stream channels, which would minimize the probability that treatment-generated sediment would directly enter the stream.

The reduction in canopy cover by logging would also reduce transpiration and cause a short term increase in surface runoff and streamflow. However, increased growth of shrubs and herbaceous vegetation would likely lead to negligible long term changes in transpiration following logging (Kelliher et al., 1986). In the long term, soil infiltration capacity would increase due to increased

shrub and herbaceous ground cover. This would result in a net gain in soil moisture and the amount of water stored as groundwater, which would lead to higher and more sustained baseflows.

Helicopter logging systems would be used to treat approximately 2,640 acres under Alternative 2. Aerial based logging systems generally cause minimal soil disturbance and generate little sediment delivery to streams relative to ground based logging systems (McIver and Starr, 2001). With helicopter logging, heavy ground disturbing equipment would not be used. Short term compaction would occur at helicopter log landings, however the helicopter landing sites would be at most two acres in size, and the extent of compaction would be minimal. The use of helicopter logging systems would likely have little to no long term negative consequences to soils or hydrology.

Under Alternative 2, approximately 20,000 acres would be treated with prescribed fire. Prescribed fires generally result in low intensity fires that lead to long term soil and hydrologic improvements, however, short term (1-5 years) negative impacts would occur. Even with low intensity fires, soils would likely become hydrophobic in localized area, and water infiltration would decrease, leading to increased runoff and erosion (Letey, 2001). However, this hydrophobicity would likely be short lived in localized areas following the low intensity prescribed fires (DeBano, 2000). Soil water infiltration capacity would increase as shrub and herbaceous vegetation began to grow, and in the long term, soil water infiltration and storage would increase.

Conifers and non-old growth junipers that have encroached into meadows would be cut and removed under Alternative 2. Prescribed fire would be utilized when appropriate to reduce slash and revitalize ground vegetation in these treatment areas. Removal of junipers and other conifers would have the net long term effect of increasing soil water storage, raising the groundwater table, and increasing stream baseflows. However, juniper removal could cause damage to the meadows depending on the timing and method used. For example, wet soils are highly susceptible to compaction, and if streams were present within the meadow, burning of vegetation adjacent to the stream channel would remove vegetation that is necessary to stabilize banks and provide stream shading. However, if resource protection measures are followed, as described in Chapter 2 of this EA, little to no adverse soil or hydrologic impacts would occur.

With Alternative 2, routine maintenance would occur on approximately 200 miles of existing transportation system roads, 32 miles of roads would be closed, and 94 miles of roads would be decommissioned. Actions would include drainage improvements such as clearing brush and trees from the travel way, ditch and culvert cleaning, slough and slide removal, blading and watering, and installation of waterbars, earthen berms and/or cross ditches. These actions all have the potential to cause short term compaction and/or increased runoff and erosion. However, these drainage improvements would ultimately divert flow off of roads, which would have the long term effect of slowing water velocity, reducing sediment delivery to the stream, increasing soil water infiltration, and increasing the amount of water stored as groundwater. Approximately 5 miles of temporary roads would be constructed, which could cause a short term increase in surface erosion and stream sediment delivery. However, the temporary roads would not be located near streams, and construction would follow BMPs to reduce surface runoff and sedimentation. Further, no temporary roads would be built across perennial stream channels, and in the event that a temporary road crossed an intermittent stream channel, all work would occur when the stream channel was dry or within the ODFW preferred instream work window. Therefore, there would be a very low potential

for sediment delivery to and transport within the stream channel. Once the temporary roads were decommissioned following project implementation, they would have no long term negative impacts.

Commercial and non-commercial thinning, prescribed fires, and road construction, maintenance, closure, and decommissioning would not all occur at once, and spatial and temporal separation of ground disturbing activities would minimize the overall impact across the entire project area at one time.

Alternative 3

Alternative 3 differs from Alternative 2 in that the number of acres to be treated using ground-based logging equipment would decline by 9.4%, from 16,764 acres to 15,118 acres. This would reduce the extent of short term impacts of ground-based logging, such as increased compaction, runoff, and erosion. However, the reduction in the amount of treated acres would increase the amount of land area still susceptible to high intensity wildfires, and the associated negative consequences to hydrology and soils, as discussed under Alternative 1 (No Action).

In addition, helicopter logging systems would not be used under Alternative 3, thereby leaving an additional 2,644 acres untreated within the project area. Helicopter logging has relatively small impacts on soil compaction, and the discontinuance of helicopter logging would likely not reduce the overall impacts of logging operations on runoff and erosion. However, as with the reduction in acres treated using ground-based logging equipment, the amount of land susceptible to high intensity wildfires and the associated negative consequences would remain higher than under Alternative 2. Further, under Alternative 3, the area of land on and around Spodue Mountain no longer treated with helicopter logging would still be burned with prescribed fire. Without first logging this area, the high stand density, thick underbrush, and steep slopes may result in higher fire intensity, and associated negative impacts to the soil in isolated pockets.

Cumulative Effects

Past actions occurring in and around the Black Hills project area include road development and maintenance, livestock grazing, fire suppression, firewood gathering, and recreation (e.g. camping, fishing, and hunting). The last time that logging occurred within the project area was during the 1980s, and as documented by recent soil surveys, the soils have recovered from any related negative impacts. Fire suppression has resulted in dense stands of smaller diameter trees, lower understory ground cover by shrub and herbaceous plant species, and encroachment of juniper and other conifers into meadows and riparian zones. Ongoing actions in and around the project area include livestock grazing, minimal road maintenance, firewood gathering, and recreation (e.g. camping, fishing, and hunting). Looking out five-plus years into the future, there are no known foreseeable future projects in the planning area.

Ongoing livestock grazing would continue to input sediment to streams at some isolated locations. Maintaining fences will help to stabilize stream banks and restore floodplain function so more sediment can be filtered out of streams during high flows. Ongoing low levels of road maintenance, firewood gathering and recreation would not measurably contribute to cumulative effects to soils or hydrologic function.

The long term cumulative effects of Alternatives 2 and 3 would be decreased surface runoff and erosion, and increased shrub and herbaceous ground cover, snow accumulation, soil water infiltration, groundwater storage, stream baseflow, and overall soil and hydrologic function. Native riparian vegetation would recover, and increased streambank shading would decrease stream temperatures. Stream water quality would improve, and stream channel morphology would no longer continue to degrade.

Fisheries and Aquatic Habitat

Existing Condition/Affected Environment

Introduction

The description of aquatic species and habitat, along with the analysis of the expected and potential effects for each alternative were assessed using relevant scientific literature, field surveys, the Lower Sycan Watershed Analysis, and professional judgment (Aquatics Report, 2011).

Existing Fish Status and Presence Information/TES & MIS Species Accounts

Table 3-10. List of Proposed, Endangered, Threatened, or Sensitive (PETS) fish species found on the Fremont-Winema National Forest

Fish Species	Listing*	Year Listed	Suitable Habitat Present	Species Present	Critical Habitat	Effects of Actions**	
						Habitat	*Species*
Klamath River Bull Trout *(Salvelinus confluentus)*	*Threatened*	1998	N	Y	N	NE	NE
Lost River Sucker *(Deltistes luxatus)*	*Endangered*	1988	N	Y	N	NE	NE
Modoc Sucker *(Catostomus microps)*	*Endangered*	1985	N	N	N	NE	NE
Shortnose Sucker *(Chasmistes brevirostris)*	*Endangered*	1988	N	Y	N	NE	NE
Warner Sucker *(Catostomus warnerensis)*	*Threatened*	1985	N	N	N	NE	NE
Goose Lake Lamprey *(Lampetra tridentate ssp.)*	*Sensitive*		N	N		NI	NI
Goose Lake Tui Chub *(Gila bicolor thalassina)*	*Sensitive*		N	N		NI	NI
Inland Redband Trout *(Oncorhynchus mykiss)*	*Sensitive*		Y	Y		NI	NI
Miller Lake Lamprey *(Lampetra minima)*	*Sensitive*		N	N		NI	NI
Oregon Lakes Tui Chub *(Gila bicolor oregonensis)*	*Sensitive*		N	N		NI	NI
Pit Roach *(Lavinia symmetricus mitrulus)*	*Sensitive*		N	N		NI	NI
Pit Sculpin *(Cottus pitensis)*	*Sensitive*		N	N		NI	NI
Trout Family *(Salmonidae)*	*MIS*		Y	Y		NI	NI

*Listing: Endangered/Threatened = ESA Federal Listing
Sensitive = R6 Regional Forester's Sensitive Species List
MIS = Management Indicator Species as listed in the Fremont Forest Plan

**Effects: ESA Listing: NE = No Effect
R6 Listing: NI = No Impact

Field reconnaissance conducted in 2008 and 2009, and past fish sampling records (ODFW 2005, USDA 2001) were used to determine the current distribution of fish, particularly Threatened,

Endangered, and Sensitive (TES) species, in and downstream of the Project Area.

- Bull trout occur within the upper Klamath Basin. Bull trout have been documented in the Upper Sycan River and its tributary Long Creek, just upstream of the project area, but have not been documented in the Lower Sycan River. Critical habitat for bull trout is designated upstream of the project area in the Upper Sycan River and the Sycan Marsh, but does not extend downstream to the Lower Sycan due to lack of potential habitat.

- Lost River and shortnose suckers - No Lost River suckers have been found to occupy the Sycan River. Shortnose suckers have been documented in the Sycan River directly downstream of the project area, below Coyote Bucket and the National Forest System Land boundary. Shortnose suckers are known to hybridize with Klamath largescale suckers, which also reside in the Lower Sycan River within the project area. Critical habitat for Lost River and shortnose suckers is designated approximately five miles downstream of the project area, off forest.

- Redband trout occur throughout the Lower Sycan River Watershed and therefore occupy habitat within the project area.

Since none of the remaining species listed in Table 3-9 above exist within the potentially affected subwatersheds, it has been determined that implementation of the Black Hills Project would have 'No Impact' on Pit sculpin, Pit roach, Oregon Lakes tui chub, Miller Lake lamprey, and Goose Lake tui chub or lamprey. The project would have 'No Effect' on Warner sucker, and Modoc sucker. Therefore these species will not be discussed further in this document.

Bull Trout

Bull trout, a species which is listed as *threatened* (USDI 1998) under the federal Endangered Species Act, exists in the Klamath Basin as a unique DPS (Distinct Population Segment). The Upper Sprague River subbasin contains four of the seven subpopulations of Klamath Basin bull trout. These populations continue to survive in fragmented and degraded habitats, and are subject to interspecific competition with non-native brook and brown trout and hybridization with non-native brook trout.

Bull trout are not currently found in the Lower Sycan River, due to poor habitat quality. However, bull trout do occur in the upper reaches of the river, in and above the Sycan Marsh. For a full summary of the life history, populations, and distribution for Klamath River bull trout, please refer to the 2007 Sprague BA (USDA, 2007).

Critical habitat for bull trout in the Klamath Basin was designated in November, 2010, which included habitat in the Upper Sycan River and Sycan Marsh. There is no designated bull trout critical habitat within the Black Hills analysis area.

Lost River Sucker/Shortnose Sucker

Lost River suckers and shortnose suckers, two sucker species listed as *endangered* (USDI 1988) under the federal Endangered Species Act, are endemic to the Upper Klamath Basin. Lost River suckers and shortnose suckers are both large, long-lived, lake dwelling fish that are found only in the

Klamath Basin above Iron Gate Dam. At the time of listing, Lost River and shortnose suckers were reported from Upper Klamath Lake and its tributaries, Lost River, Clear Lake Reservoir, the Klamath River, and the three larger Klamath River reservoirs (Copco, Iron Gate, and J.C. Boyle). The current geographic ranges of Lost River and shortnose suckers have not changed substantially since they were listed.

Upper Klamath Lake contains the largest populations of Lost River and shortnose suckers and these populations are critical for the long-term survival of both species. Lost River sucker and shortnose sucker occur within the Fremont-Winema National Forest, although neither sucker occupies habitat on the Forest within the Black Hills analysis area. The vast majority of habitat for both species occurs downstream of the Forest. The final recovery plan (USDI 1993) suggests that the decline of the Lost River and shortnose suckers are the result of 1) the damming of rivers, 2) dredging and draining of marshes, 3) water diversions, 4) hybridization, competition and predation by exotic species, 5) insularization of habitat, and water quality problems associated with timber harvest, 6) removal of riparian vegetation, 7) livestock grazing, and 8) agricultural practices.

Adult Lost River suckers are generally limited to lake habitats when not spawning, and no large populations are known to occupy stream habitats within the analysis area. Shortnose suckers, on the other hand, have resident populations in both lake and some riverine habitats, and have been documented downstream of the Black Hills analysis area. For a full summary of the life history, populations, and distribution for Lost River and shortnose suckers, please refer to the 2007 Sprague BA (USDA, 2007).

Redband Trout

Redband trout are the only Region 6 sensitive fish species known to exist in the Lower Sycan River within the project area. Redband trout are well distributed across the Forest and throughout the Klamath, Upper Sacramento, and Oregon Closed basins, existing in all fish-bearing streams. According to ODFW's *Oregon Native Fish Status Report* (2005) redband trout in the Upper Klamath Basin are a species "at risk" overall, based on limited distribution, abundance, and productivity. The report identified ten populations within the basin that vary in life history, genetics, disease resistance, and status. Of those ten populations, a resident/migratory population called the Lower Sprague population exists within the analysis area and extends the entire area from the Sycan-Sprague Rivers confluence up to Sycan Marsh and the upper Sprague River up to the Forks. This population was found to be abundant, with adequate distribution (ODFW 2005).

It is theorized that the redband trout population in the Lower Sycan River migrate from Upper Klamath Lake in the winter and spring to spawn in the river, and then migrate back downstream. Redband trout spawn in the Lower Sycan River from Torrent Spring down the confluence of the Sprague River. Two redband trout tagged in 2001 in Long Creek above the Sycan Marsh were located in Agency Lake and Klamath Lake, a migration of over 100 stream miles (USDA 2005).

Management Indicator Species (MIS)

The Fremont Forest Plan (1989, as amended) identifies the trout family as a management indicator of riparian/stream ecosystem health. Species in the project area that are members of the trout family are redband, brook, and brown trout. This analysis will use the redband trout effects analysis, as the MIS effects analysis, because redband trout are thought to be a better indicator of local

riparian/stream ecosystem health than non-native brook or brown trout, as redband trout are a native fish species and a Region 6 Sensitive Species. Redband trout occupy 15.5 miles of habitat within the analysis area.

Other Native Fish Species
The Lower Sycan River within the analysis area contains native non-listed fish species such as Pit-Klamath lamprey, speckled dace, tui chubs, marbled sculpin and Klamath largescale sucker. Another lamprey species, generally described as 'landlocked Pacific lamprey' is also reported here. This misidentified lamprey is genetically distinct from the anadromous Pacific lamprey and is referred to as the Klamath Lake lamprey (personal communication, S. Reid, 2010); the lamprey is a freshwater resident that migrates from the Upper Klamath Lake to spawn in the Sprague River and its tributaries.

Other Non-Native Fish Species
The Lower Sycan River within the project area contains introduced, non-native fish species including brown trout and brook trout.

Existing Aquatic Invertebrate Species Status and Presence Information/TES Species Accounts
The following aquatic invertebrate species shown in Table 3-11 below are listed as Threatened, Endangered, or Sensitive and are known or thought to exist on the Fremont-Winema National Forest.

Table 3-11. List of Proposed, Endangered, Threatened, or Sensitive (PETS) aquatic invertebrate species found on the Fremont-Winema National Forest

Invertebrate Species	Listing*	Year Listed	Suitable Habitat Present	Species Present	Effects of Actions**	
					Habitat	*Species*
Western Ridged Mussel *(Gonidea angulata)*	*Sensitive*		N	N	NI	NI
Montane Peaclam *(Pisidium ultramontanum)*	*Sensitive*		N	N	NI	NI
Turban Pebblesnail *(Fluminicola turbiniformis)*	*Sensitive*		N	N	NI	NI
Great Basin Ramshorn *(Helisoma newberryi newberryi)*	*Sensitive*		N	N	NI	NI
Highcap Lanx *(Lanx alta)*	*Sensitive*		N	N	NI	NI
Scale Lanx *(Lanx klamathensis)*	*Sensitive*		N	N	NI	NI
Archimedes Springsnail *(Pyrgulopsis archimedis)*	*Sensitive*		N	N	NI	NI
Lined Ramshorn *(Vorticifex effuses diagonalis)*	*Sensitive*		N	N	NI	NI

*Listing: Endangered/Threatened = ESA Federal Listing;
Sensitive = R6 Regional Forester's Sensitive Species List.

**Effects: ESA Listing: NE = No Effect
R6 Listing: NI = No Impact

Of the eight Region 6 sensitive aquatic invertebrate species listed, none are known to exist within the potentially affected subwatersheds of this project. Recent surveys (USDA 2006) across the Forest

have revealed that these eight sensitive species do not currently occupy habitat within the analysis area, therefore they will not be discussed any further in this document.

Existing Watershed, Stream Channel, and Fish Habitat Conditions
Physical stream conditions and habitat for aquatic species are interrelated, and are discussed below in an integrated fashion. Field reconnaissance conducted in 2008 and 2009, and past survey records (USDA 2001) were used to determine the current stream conditions within the Project Area. Additionally in September of 2009, the regional Restoration Assistance Team (RAT) visited sites along the Lower Sycan River to review areas of concern, such as road crossings.

Existing Watershed Conditions
The analysis area encompasses three subwatersheds (see Table 3-12). The majority of the project area lies within the Sycan River subwatershed.

Table 3-12. Subwatersheds of the Lower Sycan River Watershed

			Stream Miles	
Subwatershed	**NFL* Acres**	**Road Acres**	**Perennial**	**Intermittent**
Marsh Reservoir	1740	35	0.04	3.8
Snake River	6737	105	1.5	9.5
Sycan River	21277	456	5.3	16.9

* NFL = National Forest Lands

The primary perennial, fish-bearing stream within the analysis area is the Sycan River, and its summer base flow depends primarily on springs within the canyon of the Sycan River, such as Torrent Springs. The only other perennial streams within the project area, Blue Creek (Sycan River subwatershed) and Mill Creek (Snake River subwatershed), are both non fish-bearing due to natural or artificial channel disconnect.

The Sycan River is confined mostly to a narrow basalt canyon in the project area, with a consistent gradient of less than 0.4 % until it reaches Coyote Bucket and becomes steeper. The river has limited opportunity to develop large meander bends that would help reduce water velocities and increase fish habitat, due to its narrow canyon and lack of sufficient wide floodplains.

Additional information on watershed conditions can be found in the Hydrology and Soils section of this document.

Stream Channels and Riparian Habitat Conservation Areas (RHCAs)
There are approximately 798 acres of RHCAs within the project area. Observations in the Lower Sycan River Watershed Analysis (USDA 2005) and further field reconnaissance conducted in 2008 and 2009 are that riparian conditions are generally on an improving trend.

Aquatic Habitat

Year-round habitat for aquatic species within the project area is limited to the Lower Sycan River; seasonal habitat is available in tributaries connected to the Sycan River when water flow is sufficient.

Methodology and Assumptions

Water quality, habitat quality, and the ability of the watershed and riparian areas to act as a buffer for stream systems are components of aquatic habitat considered in this analysis. Effects of the proposal on these components were measured as follows:

Water quality

1. Water temperature
2. Sediment or fines in the system (as measured by):
    a. Percentage of fines (<2mm)
    b. Miles of roads within riparian areas
    c. Acres of potential disturbance in riparian areas

Habitat quality

1. Pool frequency (as measured by pools per mile of stream)
2. Large woody debris (as measured by pieces per mile of stream)
3. Width to depth ratio

Taken as a whole, these factors determine the complexity of habitat available for fish within the analysis area.

Fish Habitat Surveys

Aquatic habitat surveys were completed for the Lower Sycan River consisting of approximately 26 stream miles in this watershed since 2001. Water temperature data came from Fremont-Winema National Forest monitoring records. Effects to fish by way of changes in habitat components were estimated by comparison to INFISH Riparian Management Objectives (RMOs) (USDA 1995) and Interior Columbia Basin Ecosystem Management Project (ICBEMP 1997) summary values, and reports in published scientific literature. In the following analysis, stream functionality calls are made based on whether habitat objectives are being met.

Water Temperature

Water temperatures at several locations within the analysis area have periodically been recorded since 1993. Over the period from 1993-2007, the 7-day moving average of maximum daily water temperatures at the monitoring sites within the analysis area have varied from 8.7 (spring influenced) to almost 30.0 degrees Celsius.

High water temperatures within the analysis area are likely having negative impacts on fish. Water temperatures at the Sycan River monitoring sites commonly exceed temperatures ideal for the survival and growth of juvenile and adult salmonids. INFISH standards and the current US Fish and Wildlife standard for salmonids is 15.0°C (59°F) of the 7-day maximum average. Once the 7-day maximum averages reach 21°C (70°F), these temperatures are considered unfavorable to salmonids. However, it appears that native redband trout have become uniquely adapted to these extreme conditions (Behnke 1992). Overall, the Lower Sycan River is *functioning inappropriately* for stream temperatures throughout the project area.

Sediment/Substrate

During stream surveys, individual particles of substrate ranging from boulders to silt are measured; these 'pebble counts' are completed twice in each stream reach (Table 3-13). The smallest of these particles, silt/organics/sand, are often referred to collectively as 'fine sediments' or 'fines' and measure less than 2 mm. These small particles are easily held in suspension by flowing water, are easily dislodged from the stream bottom and banks, and cloud the water when disturbed. High levels of sediment loading (>20% fines) within the stream can lead to reduced quality of spawning substrate, the smothering of incubating fish eggs and can indirectly affect eggs and juveniles by reducing water flow through stream gravels leading to high levels of mortality.

Table 3-13. Percent fines in stream reaches within the analysis area.

Stream	Reach	% Pebble Count <2mm
Lower Sycan River	1	13, 23
	2	10, 19
	3	13, 16
	4	24, 20
	5	23, 30
	6	32, 25
	7	19, 32

Fine Sediment and Roads

Roads are generally major contributors of sediment to stream channels. As shown in Table 3-13 above, high levels of sediment loading have been identified in some fish-bearing reaches within the analysis area. Some of the increased fine sediment levels can be attributed to the existing road system. Field reconnaissance in 2008 and 2009 found that within the project area, there are numerous roads within the Lower Sycan River floodplain particularly near areas where road crossings exist across the river. At both the Sycan Ford crossing and the crossing below Teddy Powers Meadow, the roads parallel the river. The road crossings allow fine sediment to be delivered directly into the river, due to erosion or vehicle movement.

- Road 3462-347 crossing below Teddy Powers Meadow is a shallow graveled ford, approximately 40 feet wide and 0.5 feet maximum river depth. Affects of the road crossing both banks of the river are minimal due to negligible height and distance from the edge of the riverbank to the riverbed. On the Bly Ranger District side of the river, Road 3462-347 impacts 0.17 miles of the RHCA while on the Chiloquin Ranger District side of the river Road 4400-840 impacts 0.23 miles of the RHCA.

- Road 3462-030 crossing at Sycan Ford is a deeper crossing, approximately 60 feet wide and 2 feet maximum river depth. Vehicular approaches on the west side of the river have caused past trenching of the riverbank approximately four feet in depth with exposed soil. The east side approach is a bank slope of less than one percent with no exposed soil. Widening of the river channel, decreased river depth (increases in the width:depth ratio), and riverbank degradation is occurring at the ford. On the Bly Ranger District side of the river, Road 3462-030 impacts 0.07 miles of the RHCA while the road on the Chiloquin Ranger District side (labeled Road 4650-000) impacts 0.89 miles.

Overall, levels of fine sediment within the project area are *functioning inappropriately* as five of the seven river reaches surveyed in the analysis area showed surface fine sediment (<2mm) exceeding 20%.

Pool Frequency and Quality

Pool frequency data was collected during stream surveys within the analysis area and is displayed in Table 3-14 below. Pool frequency is an indication of habitat quantity, where pool depth can be good indicator of habitat quality. Since the number and quality of pools can determine the habitat availability for fish species, this data indicates limited habitat for resident fish.

Table 3-14. Pool frequency, average wetted width, and INFISH standards for stream reaches within the analysis area.

Stream	Reach	Pools/mile	Wetted Width	INFISH	ICBEMP 75th
	1	43	30.2	43	9.3
	2	22	33.2	40	8.4
	3	24	25.3	47	11.1
Lower Sycan River	4	18	23.1	50	12.1
	5	21	31.4	42	8.9
	6	16	24.2	49	11.6
	7	20	19.5	58	14.4

As Table 3-14 above reveals, streams in this watershed are less likely to meet standards for number of pools within, regardless of which measure of natural or desired conditions is used for comparison. Overall, pool frequencies in the Lower Sycan River are *functioning at risk* as the surveyed reaches are less than the desired condition under INFISH, but represent the ICBEMP 75th percentile for natural and near natural streams in the northern Great Basin.

Large Woody Debris

Large woody debris (LWD) data, collected during stream surveys, is summarized in Table 3-15. None of the surveyed reaches in the Lower Sycan River meet INFISH standards for large woody debris (>20 pieces per mile). The lack of wood in these reaches suggests that channel complexity and habitat quality is lower. This, in turn, limits the amount of habitat available for fish and, consequently, population sizes. The lack of large wood can indirectly lead to a reduced food supply, since large wood serves as a foundation for macro-invertebrates, the primary food source for fish.

Table 3-15. Large woody debris (large size class) within the analysis area.

Stream	Reach	LWD per mile	ICBEMP 75th
Lower Sycan River	1	3	4.4
	2	11	4.0
	3	1	5.2
	4	2	5.7
	5	6	4.2
	6	1	5.5
	7	3	6.8

It should be noted that meeting INFISH standards or ICBEMP 75th percentile for natural and near natural stream conditions for large wood may be unrealistic in this particular river system due to its unusual spring flows and its geographic location. The river is confined mostly to a narrow basalt canyon that restricts its floodplain. Previous restoration attempts to place large woody debris in the Lower Sycan have been unsuccessful due to extreme hydrograph characteristics (steep rising and falling limbs and lack of floodplain) that made the large wood structures difficult to retain. Overall, the Lower Sycan River is *functioning at risk* for large woody debris in all reaches surveyed within the project area.

Width-to-Depth Ratios

Width to depth ratios were calculated for the Lower Sycan River stream surveys (Table 3-16). All but one reach surveyed within the analysis area did not meet the INFISH standard of wetted width to maximum pool depth of less than 10. Low width-to-depth ratios indicate narrow deep channels that provide cover and greater habitat availability than do shallower and wider channels, which is an indication of good habitat quality.

Table 3-16. Width-to-Depth Ratios in stream reaches within the analysis area.

Stream	Reach	W/D Ratio
Lower Sycan River	1	41.7
	2	66.4
	3	9.7
	4	15.0
	5	64.9
	6	22.9
	7	63.1

The Lower Sycan River is a system confined within a narrow canyon, with a consistent low gradient from Reach 3 and above. This type of low gradient stream usually exists in broad valleys that allow the stream to meander, creating undercut banks and lateral scour pools for greater fish cover habitat. Confined to a narrow canyon, the Lower Sycan River does not function as expected for this type of system.

Environmental Consequences to Aquatic Species

Alternative 1 – No Action

Alternative 1 would have no direct effects on any fish species as no activity would take place in or adjacent to any fish habitat. Alternative 1 would likely result in long-term detrimental effects to sensitive redband trout in the project area and endangered suckers downstream of the project area. Under Alternative 1, no action would be taken to protect water storage capacity and fish habitat reaches. Also, no action would be taken to reduce upland effects on fish habitat by thinning encroaching conifers from meadows, aspen stands and other riparian areas, and decommissioning, closing, reconstructing, and maintaining roads. No action would be taken which could reduce the potential of devastating wildfires. In summary, Alternative 1 would leave the project area in its current condition and undesirable fish habitat conditions would persist into the foreseeable future, as a passive approach to watershed restoration would be employed.

Effects Common to Alternatives 2 and 3

The only proposed activities most likely to affect fish are thinning within riparian areas, road management within riparian areas, and prescribed burning. These proposed activities are similar in Alternatives 2 and 3, and will be discussed together below.

Direct effects to aquatic PETS species (bull trout, shortnose suckers, Lost River suckers, and redband trout) would not occur with implementation of this project as no activities are expected to take place in any fish-bearing stream channel. To further reduce the likelihood of direct effects to fish, resource protection measures listed in Chapter 2 would be fully implemented.

Determination of Effects to Aquatic Species

On the basis of the above evaluation, if the project is implemented as described in the project proposal (Alternative 2 and/or 3), the potential for adverse impacts to listed bull trout, shortnose suckers and Lost River suckers, and sensitive redband trout, is very low. This project may impact individuals, but would not contribute to a loss of species viability or lead to federal listing of any PETS fish species or aquatic invertebrate species.

Due to the low flow regime of the Lower Sycan River and the lack of potential habitat for bull trout, the project would have ‘no effect’ on Klamath Basin bull trout and bull trout critical habitat.

Critical habitat on the Sycan River for Lost River and shortnose suckers is designated downstream of National Forest Lands and the project area. Critical habitat for these suckers is limited to low gradient reaches of streams and there is no known occurrence of Lost River or shortnose suckers within the analysis area. Therefore, the Black Hills project would have ‘no effect’ on Lost River and shortnose suckers or their critical habitat.

Redband trout are known to occur within the analysis area. However, there would be no direct activity (vegetation thinning) to occur within occupied redband trout habitat, the Lower Sycan River. Road decommissioning or maintenance and prescribed burning could occur adjacent to occupied habitat, but is not likely to have direct impacts to fish and is expected to be beneficial to fish habitat. Based on the activities described above, this project would have ‘no impact’ on redband trout or the

MIS-listed trout family. The project would improve habitat conditions for MIS species redband trout in the project area. Therefore, the Black Hills Project will not contribute to a negative trend in viability on the Fremont National Forest for redband trout.

Cumulative Effects

No adverse cumulative effects to fish populations are expected under Alternative 2 or Alternative 3 because the project activities would not have effects to aquatic species. Any cumulative watershed effects resulting from implementation of the Black Hills Project are expected to be beneficial to existing fish populations, based on the expected long term improvements to watershed health. No short- or long-term redband trout population decrease would occur; therefore additive cumulative effects are not anticipated.

Environmental Consequences to Aquatic Resources

The following are specific variables that are used to determine the quality of aquatic habitat in streams within the Project Area. The proposed activities are similar in Alternatives 2 and 3, and will be discussed together below.

Water Temperature

Alternative 1 – No Action

Since vegetation would remain untreated under this alternative there would be no direct effects to any riparian vegetation cover or stream temperatures.

Effects Common to Alternatives 2 and 3

Vegetation within 528 acres in Alternative 2 and 363 acres in Alternative 3 of riparian areas may be disturbed during riparian thinning in this project. Along perennial streams, treatments within riparian areas (11 acres) may remove some existing shade-providing trees in the short term. In the long term, removal of these conifers would allow for greater growth of the remaining stand and increased shade on these streams. Treating these stands along perennial streams would not result in increased stream temperatures downstream on fish-bearing waters.

Prescribed burning would be applied to 20,000 acres within the project area. Of these, 11 acres are within perennial stream riparian and 517 acres in Alternative 2 or 352 acres in Alternative 3 are within intermittent stream riparian. Burning in riparian areas would be done under controlled conditions so vegetation loss near streams is unlikely. Prescribed fire may produce water temperature increases through reduction of streamside shade (Amaranthus et al. 1989), though prescribed fire would be implemented in such a way as to not remove any existing shade on streams already below standards.

Reducing roads within riparian areas, as recommended in the project's Roads Analysis, would allow more vegetation to grow near streams and increase the potential of shade cover in the future.

Cumulative Effects

Some past activities, including thinning in riparian areas, road construction and maintenance, grazing, wildfires, fencing riparian areas, and riparian planting have all likely affected stream temperatures.

Past harvest activities removed some trees that provided shade to streams within riparian areas. Road construction in riparian areas or crossing creeks removed riparian vegetation along the roadbed; in some cases this left long stretches of streams without shade. Grazing of riparian areas in the past removed vegetation that was providing shade and also caused higher stream width to depth ratios through bank trampling. This created a larger surface area versus depth increasing the efficiency of solar radiation heating up streams. Grazing has been modified since this time and most past effects to shade are recovering.

Other past activities have increased shade and contributed to lower stream temperatures. Non-commercial thinning in riparian areas, after a brief reduction in shade, encouraged remaining trees and shrubs to grow larger so that they provide more shade than the original stand. Riparian fencing on the Lower Sycan River has allowed riparian vegetation to recover, providing more shade to the stream. Riparian planting along the Lower Sycan River following stream restoration has also led to an increase in riparian vegetation and a reduction in stream temperature.

A present activity that can contribute to an increase in stream temperature is grazing. The remaining unfenced portions of streams within the cattle allotment in the analysis area continue to be impacted by grazing with a reduction in riparian vegetation at isolated locations. Still the effects on stream temperatures from grazing are at immeasurable levels in the planning area.

There are no future foreseeable activities proposed for this watershed that would affect stream temperatures.

All activities that reduce stream shade could potentially increase stream temperatures. Currently much of the past reduction in shade is recovering or will continue to recover in the future. Overall there would still be some roads that would contribute to a reduction in shade along some segments of streams. Grazing would still impact riparian vegetation on some streams, but with current management little impact to stream temperatures should be seen. Activities proposed in this project could cumulatively decrease the amount of shade on affected stream reaches in the short term, but since so few trees would be felled near perennial streams no measurable cumulative effect to stream temperatures is expected.

Together the ongoing actions along with the actions of Alternative 2 or 3 would result in immeasurable effects to stream temperatures in the planning area and the Lower Sycan River.

Sediment/Substrate

Alternative 1 – No Action

The Existing Condition/Affected Environment of percent fines would continue in streams within the Black Hills analysis area. Since vegetation would remain untreated under this alternative there

would be no direct effects to any riparian area that would result in sediment exposure. No haul would occur on any roads related to this project so no additional sediment would be mobilized into creeks as a result of that activity. No prescribed fire would occur so no soil would be exposed within RHCAs that would have the potential to enter into creeks. Existing roads would not be hydrologically stabilized, and sediment from unmaintained roads would continue to enter streams.

Effects Common to Alternatives 2 and 3

Thinning, decommissioning and closing roads, underburning and fire lines associated with prescribed burning outside of RHCAs could result in some soil exposure. Mitigation measures would minimize soil disturbance and keep it far enough away from streams so potential sediment from these sources would not impact streams and would not increase embeddedness.

Thinning and prescribed burning within riparian areas may also expose soil. Burn intensities would be expected to be low and localized, and re-sprouting of vegetation could occur within two weeks of soil exposure (Agee 1993). Project design criteria were established to control sediment so there is not expected to be a measurable increase in sedimentation and would also not likely lead to an increase in embeddedness.

Cumulative Effects

The activities contributing sediment to streams, if left as is, would continue to impact aquatic habitats. Actions taken in the past were an attempt to reduce the amount of sediment entering into streams by fencing off sections of Lower Sycan River. Today only grazing on small sections of the Lower Sycan River and existing roads are still contributing sediment to streams. Most activities, while they may cumulatively contribute to sediment mobilization, would not cumulatively add to the amount of sediment in streams due to riparian buffers and several mitigation measures designed to keep sediment from reaching streams. Though road decommissioning may contribute to additional sediment input in the short term, these roads would stabilize once closed or decommissioned.

The Sycan River subwatershed may have experienced an increase in sediment load due to past management activities including road construction, timber harvest, wildfire suppression, grazing, and failure of instream fish structures. Road construction increased the drainage area with stream crossings that allow sediment to be transported directly to the streams from roads. Grazing in the past caused bank destabilization, which contributed sediment to the fish-bearing river within the project area. Several instream structures, made up of large wood and boulders, were constructed in the 1990s in the Lower Sycan River. Some of these structures caused bank erosion contributing sediment to the streams; these structures have since been removed. Past activities that have reduced sediment input into streams include fencing sections of the RHCA on the Lower Sycan River in the livestock allotment has allowed riparian vegetation to recover providing more structure for increased bank stability and less trampling of the bank.

Present activities that are contributing to an increase in sediment transport to streams include grazing and existing roads. There are still some unfenced areas of the river in cattle allotments that are impacted by grazing. Continued grazing is still causing bank destabilization at some isolated locations. Several roads in riparian areas are chronic sediment sources for area streams. Other

activities that are impacting sediment input into streams include vehicles use in the Lower Sycan River at two main road crossings (fords).

Future foreseeable activities are proposed for this subwatershed that would affect sediment load is grazing that continues in the analysis area and though minimized, would continue to input sediment at isolated locations. Maintaining fences will help to stabilize stream banks and restore floodplain function so more sediment can be filtered out of streams during high flows.

Pool Frequency and Quality

Alternative 1 – No Action

No activities would occur under this alternative that would directly affect pool quantity or quality. Due to the dynamic nature of stream channels, pool quantity and quality would continue to change over time with high flows, as a channel migrates or new large wood enters the system.

Effects Common to Alternatives 2 and 3

During thinning operations conifers may be removed from RHCAs reducing the amount of large wood that may potentially fall into the creek and potentially create more pools. Riparian thinning may occur in a total of 528 acres in Alternative 2 or 363 acres in Alternative 3. Most riparian thinning would occur along intermittent channels and the only perennial stream channels affected are non-fish bearing. Therefore, it is not expected that there would be a sufficient quantity of trees removed to affect future pool formation within fish habitat. Thinning within riparian areas may expose soil. Mitigation measures would minimize soil disturbance and keep it far enough away from streams so potential sediment from these sources not impact streams and not enter streams in a sufficient quantity to affect pool quality. No measureable effects to pool quantity or quality are expected to occur as a result of vegetation treatments.

Prescribed fire could be backed into riparian areas within burn blocks and may create some potential future large wood and expose soil. This may indirectly increase the number of pools in the future. Burning in riparian areas would be done under controlled conditions so loss of existing large wood that form pools is not likely. Burn intensities would be expected to be low and localized, and re-sprouting of vegetation could occur within two weeks of soil exposure (Agee 1993). Ignition of fire would cease 50 feet from stream channels and no firelines would occur within RHCAs, so no alterations to pool quantity or quality would occur as a result of this activity. There would not be a sufficient amount of sediment generated from underburning in RHCAs to affect pool quantity or quality.

A reduction in the overall number of open roads following project implementation, as proposed in the project's Roads Analysis, would reduce sediment input to streams, improving fish habitat.

Cumulative Effects

Some past activities including thinning in riparian areas, road construction and maintenance, grazing, wildfire suppression, fencing riparian areas, riparian planting and installation of instream structures have all likely affected pools or pool quality.

Road construction along or crossing creeks disturbed the stream channel at each of these crossings. Pools may have been lost at some of these crossings when gravel was placed in the stream channel to facilitate vehicle crossing. Grazing of riparian areas in the past has led to bank trampling which increased the amount of sediment entering streams affecting pool quality downstream. Grazing has been modified since this time and most past effects to stream banks are recovering. Modifying grazing has also allowed for willows to recover, which has allowed the return of multiple beaver colonies in perennial streams. Activities by beavers help to create deeper pools that can help fish survive periods of low flow and/or drought conditions (Collen & Gibson, 2001).

In the 1990's, instream structures were constructed from large wood and boulders on the Lower Sycan River to create more pools and may have contributed to short-term effects of riparian vegetation, bank stability, and exposed soils. Since that time, most of the structures have been removed due to the extreme high flows experienced in the river channel. Riparian fencing along sections of the Lower Sycan River has allowed riparian vegetation and bank stability to recover improving pool quality within and downstream of this exclosure.

Future foreseeable activities proposed for this watershed that would affect pools include grazing. The remaining unfenced portions of stream within the cattle allotment in the analysis area will continue to be impacted by grazing, which can lead to a reduction in pool quality at isolated locations. Grazing has been modified and most past effects to stream banks are recovering and very little effect to pool quality is expected.

Past, ongoing and future activities along with the actions proposed by Alternative 2 or 3 would not result in measurable cumulative effects to pool frequency and quality.

Large Woody Debris

Alternative 1 – No Action

Since vegetation would remain untreated under this alternative there would be no direct effects to any riparian vegetation. Trees within RHCAs would continue to age and fall into creeks creating new large wood. Reductions in meadows, aspen and willows would occur due to continued conifer encroachment.

Effects Common to Alternatives 2 and 3

During thinning operations conifers may be removed from riparian areas, reducing the amount of large wood that may potentially fall into the creek. Riparian area thinning may occur in a total of 528 acres in Alternative 2 or 363 acres in Alternative 3. Only 11 of these riparian acres are along perennial streams. Most riparian thinning would occur along intermittent channels and the only perennial stream channels affected are non-fish bearing. Therefore, it is not expected that there would be a sufficient quantity of trees removed to affect future large wood production within these streams.

Prescribed fire could be backed into riparian areas within burn blocks and may create some potential future large wood and expose soil. Burning in riparian areas would be done under controlled conditions so loss of existing large wood is not likely. Burn intensities would be expected to be low

and localized, and re-sprouting of vegetation could occur within two weeks of soil exposure (Agee 1993). Ignition of fire during prescribed burning would cease 50 feet from stream channels and no firelines would occur within riparian areas, so no alterations to large wood production would occur as a result of this activity.

Reducing roads within riparian areas, as recommended in the project's Roads Analysis, would allow more trees to grow near streams and increase the potential of large wood in the future.

Cumulative Effects

Some past activities including thinning in riparian areas, road construction and maintenance, wildfire suppression, aspen stand restoration, and riparian planting have all likely affected large wood. Past harvest activities removed some trees that would have been potential large wood within riparian areas. Road construction along or crossing creeks removed all riparian vegetation along the roadbed. In some cases this removed trees that would have become large wood once it fell into the stream. In past stream restoration projects, large wood structures were strategically placed in the Lower Sycan River in an attempt to increase large wood numbers, but the extreme high flow events that occur in the river corridor scoured out all the structures.

There are no ongoing or future activities proposed for this watershed that would affect large wood. The actions of Alternatives 2 or 3 are not expected to alter large wood production or concentrations in RHCAs, so there would be no cumulative effects to large woody debris for streams.

Width-to-Depth Ratios

Alternative 1 – No Action

The Existing Condition/Affected Environment of width to depth ratios would continue in streams within the Black Hills analysis area. The width to depth ratios would continue to change as the result of high flows and channel migration. No activities would occur under this alternative that would lead to direct effects to any riparian area that would affect sediment exposure or stream banks that could result in a change to width to depth ratios.

Effects Common to Alternatives 2 and 3

Thinning, decommissioning and closing roads, underburning and fire lines associated with prescribed burning outside of riparian areas could result in some soil exposure. Mitigation measures would minimize soil disturbance and keep it far enough away from streams so potential sediment from these sources not impact streams and not increase embeddedness.

Riparian thinning and prescribed burning may also expose soil. Burn intensities would be expected to be low and localized, and re-sprouting of vegetation could occur within two weeks of soil exposure (Agee 1993). Project design criteria were established to control sediment so that is not expected to be a measurable increase in sedimentation and would also not likely lead to an increase in width to depth ratios.

Cumulative Effects

Width to depth ratios are generally affected by excessive sediment input into streams or modification of stream banks and channels. Past activities that have impacted width to depth ratios include grazing. Grazing caused higher width to depth ratios through bank trampling and excessive sediment input to streams. Sections of the Lower Sycan River were fenced to exclude cattle to resolve a site specific issue associated with bank trampling and riparian vegetation loss. Future activities that will impact width to depth ratios include continued grazing. Grazing would still impact riparian vegetation on some streams, but with current management little impact to stream banks and width to depth ratios would be expected.

While some past activities, primarily grazing, have likely affected width-to-depth ratios, no cumulative effects would occur from the activities proposed under any of the action alternatives.

Consistency with INFISH and Attainment of RMOs

The commercial and non-commercial thinning portions of this project would not retard or prevent attainment of Riparian Management Objectives (RMOs) or adversely affect native fish (TM-1and FM-1 of INFISH), as no adverse direct or indirect effects to any fish species is expected. All RHCAs treatments are designed to acquire desired vegetation characteristics in order to attain RMOs (TM-1 and TM-2 of INFISH). Fuels reduction in the project area would reduce the risk of wildfire and its effects on fish habitat described above, thereby contributing to the attainment of RMOs (FM-4 of INFISH).

The project area is not in an INFISH priority watershed. None of the alternatives involve road construction within RHCAs. Proposed road decommissioning, closure, reconstruction, and maintenance would serve to accelerate attainment of RMOs and are fully consistent with the goals and applicable INFISH Standards and Guidelines, particularly, RF-2 and FW-1 of INFISH.

The greatest potential to retard the attainment of RMOs with Alternatives 2 and 3 stems from the potential sediment delivery to streams resulting from harvest activities within RHCAs. The amount of sediment delivered to streams in the short term is expected to be at an immeasurable level compared to the existing site conditions and is expected to be reduced in the long term. Therefore, implementation of Alternatives 2 or 3 is not expected to retard the attainment of RMOs.

Implementation of the Black Hills Alternative 2 or 3 is not expected to adversely affect inland fish nor would it prevent attainment of RMOs as described in INFISH.

Terrestrial Wildlife

Existing Condition/Affected Environment

From a wildlife and wildlife habitat standpoint there is no difference in effects to species or their habitat between Alternatives 2 and 3. Alternative 2 would treat more acres, but the effects would be essentially the same; therefore, their affects are discussed together. Table 3-17 below identifies wildlife species status, and documents whether the species or habitat is present for them within the Black Hills Project area. If a species is not present or does not have habitat occurring within the proposed project area, it is not discussed further in this document.

Table 3-17. Wildlife Species, Status, Presence, Habitat Occurrence, and Comments for the Black Hills Project Area.

Species	Status	Species Present	Habitat Present	Comments
Columbia Spotted Frog *Rana luteiventris*	Candidate/ FS Sensitive	Not Suspected	Yes	Best available habitat on Ranger District has been surveyed with no detections.
Lynx *Lynx canadensis*	Threatened	No	No	No habitat.
Oregon Spotted Frog *Rana pretiosa*	Candidate/ FS Sensitive	Not Suspected	Yes	Best available habitat on Ranger District has been surveyed with no detections.
Yellow-billed Cuckoo *Coccyzus erythropthalamus*	Candidate	No	No	No habitat.
Bald Eagle *Haliaeetus leucocephalus*	FS Sensitive/ MIS Species	Yes	Yes	Incidental sightings
Northern Leopard Frog *Rana pipiens*	FS Sensitive	Not Suspected	Yes	Best available habitat on Ranger District has been surveyed with no detections.
Northwestern Pond Turtle *Clemmys marmorata marmorata*	FS Sensitive	Not Suspected	Yes	Habitat present.
Bufflehead *Bucephala albeola*	FS Sensitive	Suspected	Yes	Habitat present.
California Wolverine *Gulo gulo*	FS Sensitive	Suspected	Yes	Habitat present.
Fringed Myotis *Myotis thysanodes*	FS Sensitive	No	No	No habitat.
Greater Sage Grouse *Centrocerus urophasianus phaios*	FS Sensitive	No	No	No habitat.
Horned Grebe *Podicepes auritus*	FS Sensitive	No	No	No habitat.

Table 3-17. (continued) Wildlife Species, Status, Presence, Habitat Occurrence, and Comments for the Black Hills Project Area.

Species	Status	Species Present	Habitat Present	Comments
Least Bittern *Coccyzus erythropthalamus*	FS Sensitive	No	No	No habitat.
Pallid Bat *Antrozous pallidus*	FS Sensitive	Suspected	Yes	Habitat present.
Peregrine Falcon *Falco peregrinus anatum*	FS Sensitive/ MIS Species	No	No	No habitat. MIS representative of Endangered Species
Pygmy Rabbit *Brachylagus idahoensis*	FS Sensitive	No	No	No habitat.
Tricolored Blackbird *Agelaius tricolor*	FS Sensitive	No	No	No habitat.
Upland Sandpiper *Bartramia longicauda*	FS Sensitive	No	No	No habitat.
Yellow Rail *Coturnicops noveboracensis*	FS Sensitive	No	No	No habitat.
American Marten Martes americana	MIS Species	Suspected	Yes	Habitat present. MIS representative of high elevation forests, both lodgepole pine and mixed conifer.
Black-backed Woodpecker Piciides arcticus	MIS Species	Yes	Yes	Habitat present. MIS representative of overmature/mature lodgepole pine.
Mule Deer Odocoileus hemionus	MIS Species	Yes	Yes	Occur throughout project area. MIS representative of hunted species.
Northern Goshawk *Accipiter gentilis*	MIS Species	Yes	Yes	2 year surveys, no known territories, incidental sightings. MIS representative of overmature/mature ponderosa pine and mixed conifer.
Pileated Woodpecker *Dryocopus pileatus*	MIS Species	Yes	Yes	Habitat present. MIS representative of overmature/mature mixed conifer.
Red-naped Sapsucker *Sphyrapicus nuchalis*	MIS Species	Yes	Yes	Habitat present. MIS representative of aspen and deciduous riparian ecosystems.
Primary Excavators	MIS Species	Yes	Yes	Occur throughout project area.
Partners in Flight	Focal Species			Pine vegetation type. Mixed Conifer vegetation type.
U.S. Fish and Wildlife Service	Birds of Conservation Concern	Yes	Yes	Various habitats.

Note: Species habitat descriptions are contained in a separate Wildlife Habitat Report contained in the project filet. If a species has no habitat within the proposed project area it will not be further analyzed in this document.

Threatened, Endangered, and Candidate Terrestrial Wildlife Species

The Oregon spotted frog and Columbia spotted frog are Federal candidate species for listing under the Endangered Species Act. However, they are also Forest Service sensitive species, and were addressed as a part of the Biological Evaluation for this project. If these species are listed before implementation of the proposed projects, those projects would likely require a Biological Assessment, and possibly consultation with the U.S. Fish and Wildlife Service.

Climate Change – All Alternatives

There are many models and programs available that discuss predictions and relate it back to effects on vegetation, which equates to effects on habitat for wildlife species. While, these effects can be quantified in models, there is not necessarily agreement between models regarding the severity, timing, or exact changes that are predicted to occur in the future. The information presented here and much more can be found on the Climate Change Resource Center website related to vegetative changes (http://www.fs.fed.us/ccrc/topics/vegetation.shtml).

It is expected that the weather pattern will become warmer and dryer with more moisture coming in the form of rainfall instead of snow pack. The treeline will rapidly extend to the north, sequestering carbon from the atmosphere into the biosphere. Such gains in sequestered northern carbon also will be accompanied by enhanced forest growth over much of the temperate to higher latitudes over the early part of the 21st century; increases in high-latitude precipitation increases, longer growing seasons, and elevated CO^2 concentration will facilitate this growth (Neilson et al. 1998, Scholze et al. 2006). However, with further warming, rapidly increasing evaporative demands will likely cause widespread drought stress in boreal and temperate forested and nonforested ecosystems (Neilson et al. 1998, Scholze et al. 2006). This widespread temperature-induced drought stress is expected to cause dramatic increases in the amount of biomass consumed by fire throughout much of the boreal forest, especially in continental interior regions. The drought-insect infestation processes currently underway are expected to continue. Drought and fire are expected to increase in both the western and eastern forests of the United States (Bachelet et al. 2001, in press; Lenihan et al., in press.). Parts of the interior West could experience increased precipitation, causing both enhanced woody expansion and increased fire, as a consequence of more fuel (Bachelet et al. 2001; Lenihan et al., in press).

Habitat for species will change at a faster rate, untreated stands will experience drought related stress and mortality that would benefit woodpeckers and cavity nesting species at the expense of species that require denser canopies for nesting, resting, roosting, and protection from predators. Ultimately, this would lead to the creation of additional early seral vegetation conditions that would benefit mule deer, elk and ground nesting bird species. Alternatives 2 and 3 would provide a buffer against the projected future conditions by thinning trees and reducing competition for limited resources such as moisture. This would help provide forested habitat for a longer period of time versus Alternative 1.

Region 6 Sensitive Wildlife Species on the Fremont-Winema National Forest

The Forest Service Region 6 Sensitive Animal list (January 2008) was reviewed for species that may be present within the project area. Table 3-18 below lists the summary of conclusion of effects from the *Biological Evaluation for Sensitive Terrestrial Wildlife Species* (Ramsey, 2010) within the Black Hills Project Area for those species where an affect was documented.

Table 3-18. Summary of Conclusion of Effects from Biological Evaluation for Sensitive Terrestrial Wildlife Species for the Black Hills Project

R6 Sensitive Species with Individuals or Habitat Present	Alternative 1 No Action	Alternative 2	Alternative 3
Bald eagle	NI	MIIH	MIIH
Bufflehead	NI	MIIH	MIIH
California wolverine	NI	MIIH	MIIH
Columbia spotted frog	NI	MIIH	MIIH
Evening field slug	NI	MIIH	MIIH
Johnson's hairstreak	NI	MIIH	MIIH
Lewis' woodpecker	NI	MIIH	MIIH
Northern leopard frog	NI	MIIH	MIIH
Northwestern pond turtle	NI	MIIH	MIIH
Oregon spotted frog	NI	MIIH	MIIH
Pacific pallid bat	NI	MIIH	MIIH
White-headed woodpecker	NI	MIIH	MIIH

NI = No Impact

MIIH = May impact individuals or habitat, but will not likely contribute to a trend toward federal listing or loss of viability to the population or species.

Management Indicator Species

There are no specific standards and guidelines for Management Indicator Species (MIS), however, the Forest Plan requires that sufficient habitat quantity, quality, and diversity be provided to maintain self-sustaining populations across the Forest. The bald eagle is addressed in the *Biological Evaluation for Sensitive Terrestrial Wildlife Species* (Ramsey, 2010) for the Black Hills Project.

Environmental Consequences

Alternative 1 – No Action – All Management Indicator Species

This alternative would not affect the species or their habitat listed in Table 3-17 above as either being present or having habitat present because there is no action planned. No commercial thinning, small tree thinning, prescribed fire or other restoration activities would occur in the planning area.

Stand structures would remain the same in the near term, with a continuation of increased density and layering. This would favor species that are provided habitat from closed canopies such as goshawks, pine martens and canopy nesting birds. Long term the risk of stand replacing events such as insect outbreaks and stand replacing fire would continue to climb. Stand replacing events, fire or

insects would eventually have the result of reducing late, old and mid succession forest to earlier stages, an undesirable outcome. When this occurs, these stands would then favor disturbance dependant and early successional species such as black-backed woodpeckers.

As stand densities near maximums (a large number are there or nearing that level now), density dependent stress mortality would increase. Individual large and medium diameter conifers would continue to die from site resource competition and continued insect and disease mortality. This would provide a habitat pulse for species that require large diameter snags such as pileated woodpeckers. Conditions are, and would continue to be ripe for large increases in bark beetle caused mortality, with the large old desirable trees at most risk. Since there are a limited number of large diameter trees, eventually this habitat component would be limited.

There would be little or no increase in understory grasses, forbs and brush species. These plants would continue to decline as litter layers deepen and conifers continue to utilize the limited site resources. Aspens, willows and other riparian vegetation would continue to decline and possibly disappear on some sites. Habitat for early successional species would continue to decline in quantity and quality.

The number of acres with a high risk of stand replacement fire would continue to increase. Litter layers over most the area would continue to build up and an increase in woody fuels will occur as trees die, increasing future surface fire intensities. Crowns in the un-thinned stands would continue to increase in crown bulk density, and crown heights would continue to be low, creating undesirable ladder fuels.

Managed and dedicated old growth stands would continue to see increases in mortality as stand densities increase and/or trees are killed by mountain pine beetles. This would move these stands towards providing high snag and down wood densities until they were removed by wildfire. At which point in time, they would provide neither old growth nor deadwood habitat.

Primary Cavity Excavators

Primary Cavity Excavators are an MIS group of species represented in this document and analysis by snags and down wood, red-naped sapsuckers, black-backed woodpeckers and pileated woodpeckers.

Existing Condition/Affected Environment

Snags and Down Wood

Within the planning area, snag levels appear to meet Forest standards and guidelines of 4 snags per acre, and snags greater than twenty inches diameter appear to be under-represented. This Standard was developed when the Forest issued a "White Paper" to document what would meet the biological population potential identified in the Eastside Screens (Regional Forester's Eastside Forests Plan Amendment #2). Existing snag levels vary across the area depending upon past management practices, which includes timber harvest, fuels treatment within units, and past fuels projects on the landscape. A qualitative reconnaissance found areas with no snags and pockets of 20+ snags across the planning area. In plantations, snag habitat is generally lacking while in unmanaged areas snag habitat is being created by white fir, ponderosa pine, and lodgepole trees dying from drought stress,

bug kill or fire events. Down wood levels have not been measured in the planning area and it is unknown if we are meeting Forest Plan standards or how the area compares to inventory data in DecAID (Decayed Wood Advisor for Managing Snags, Partially Dead Trees, and Down Wood for Biodiversity in Forests of Washington and Oregon, Mellen et.al. 2006). See Appendix C for additional information related to DecAid, snags, down wood, and wildlife species.

Environmental Consequences

Effects Common to Alternatives 2 and 3

The intent of the proposed project is not to remove snags from the proposed project area but to thin live trees. Snags are only to be cut if they are a safety hazard. Snags that are cut as danger trees along roads may be removed, while snags cut as hazard trees within units should be retained where there is a lack of down wood.

Thinning would decrease stand densities and create more open stands like those that historically occurred in the area. This would benefit species that prefer open stands, but have a negative effect on species that prefer denser conifer stands. Alternative 3 would treat fewer acres, and therefore, would leave some denser stands that would produce more snags over time. Across the subwatersheds, this would still likely be within the range of historical conditions, but on the high end. The proposed activities would also improve stand health, which would decrease the number of snags created annually in the proposed project area. However, trees would become larger faster, and thereby provide for larger snags in the future. Untreated areas would continue to provide increased snag densities. Overall, stand densities would be decreased, yet still remain fully stocked and within the historical range of variability for stand density. Reducing stand densities would have a long-term positive effect by reducing the risk of stand-replacing wildfires. Prescribed fire may reduce snag numbers but would also create new snags that could provide habitat for cavity-dependent species and improve foraging conditions.

Tables 3-19 through 3-21 below were developed by the Silviculturist on the planning team by using vegetation stand data in FS-Veg and growing stands to current conditions. Then these stands were put into the Forest Vegetation Simulator, and grown out with data summarized at 10 year increments. What the model shows based on the tables below is that there would be some minor differences in snag densities over time, but that essentially there is very little difference in snag recruitment over time whether the stands are thinned or not.

Table 3-19. Lodgepole pre- and post-treatment snag densities within the proposed Black Hills Restoration Project area

	Pre-Treatment						Post-Treatment					
	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"
2010	68.9	1.2	0.1	0	0	0	20.6	0.9	0.2	0	0	0
2020	69.7	1.3	0.1	0	0	0	7.15	0.8	0.4	0.1	0	0
2030	116.8	2.6	0.2	0.1	0	0	2.1	0.8	0.6	0.1	0.1	0
2040	119.7	3.7	0.4	0.1	0	0	0.9	0.9	0.8	0.2	0.1	0.1
2050	108.3	4.5	0.6	0.1	0.1	0.1	20.6	0.9	0.2	0	0	0

Table 3-20. Pine Associated pre- and post-treatment snag densities within the proposed Black Hills Restoration Project area

	Pre-Treatment						Post-Treatment					
	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"
2010	99.5	3.2	1.3	0.6	0.1	0	13.1	3.4	2.4	0.9	0.2	0.1
2020	76.2	3.6	1.9	0.8	0.2	0.1	4.9	3.7	3.1	1.4	0.4	0.1
2030	64.4	4	2.4	1.1	0.4	0.1	4.3	4.1	3.8	1.9	0.7	0.1
2040	80.4	4.5	2.8	1.5	0.5	0.1	4.4	4.4	4.2	2.4	0.9	0.2
2050	81	5.4	3	1.8	0.6	0.2	13.1	3.4	2.4	0.9	0.2	0.1

Table 3-21. Ponderosa Pine pre- and post-treatment snag densities within the proposed Black Hills Restoration Project area

	Pre-Treatment						Post-Treatment					
	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"	>=00"	>=12"	>=18"	>=24"	>=30"	>=36"
2010	50.5	3.4	2.2	1.4	0.4	0.1	18.0	4.3	2.6	1.6	0.4	0.1
2020	60.8	4.4	2.5	1.7	0.6	0.1	11.3	5.0	2.8	1.8	0.5	0.1
2030	68.0	5.2	2.7	1.9	0.6	0.1	9.4	5.6	3.0	1.8	0.6	0.2
2040	67.5	6.0	2.8	1.9	0.7	0.2	8.9	6.3	3.1	1.9	0.6	0.2
2050	63.7	7.2	2.9	2.0	0.7	0.2	18.0	4.3	2.6	1.6	0.4	0.1

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the Forest scale. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of snags and down wood is expected on the Fremont National Forest.

Existing Condition/Affected Environment

Red-naped Sapsuckers

Red-naped sapsuckers are closely associated with aspen, deciduous riparian and coniferous forest stands. These birds get their name from their foraging strategy, which consists of drilling neat horizontal rows of holes in tree trunks and then returning to those holes to feed on the running sap and the insects attracted to it. They will also eat fruits. Unlike woodpeckers, they forage in healthy trees and can actually kill a tree if they drill too many sap holes around its trunk, although it's quite uncommon (http://birdweb.org/birdweb/bird details.aspx?id=272). Other species that benefit from large aspen trees and snags are the house wren, mountain bluebird, Williamson's sapsucker, tree swallow, and northern flicker.

Sapsuckers will breed in mixed coniferous forests and will use open- and closed-canopy forests, burns and clear cuts, if there are some remaining standing trees (http://birdweb.org/birdweb/bird details.aspx?id=272). Sapsucker species require older trees with heart rot for nesting as well as adjacent aspen, conifers or mountain mahogany for sap well feeding. Habitat recommendations include >10% cover of aspen saplings in the understory to provide adequate representation of younger seral stages for replacement, >14 trees and >4 snags per 1.5 acres that are >39 feet in height and 10 inches dbh, and a mean canopy closure of 40-80% (Altman and Holmes 2000). Red-naped sapsuckers are primary excavators, providing cavities for many other bird species (Neel 1999). Breeding Bird Survey trend analysis has reported a 13% decline for red-naped sapsuckers in the Basin and Range Province between 1966 and 1996 (Neel 1999). Generally, aspen stands are

declining throughout the western U.S. and may be currently at 5% of pre-settlement occurrence (Wall et al. 1999).

There are approximately 200 acres of aspen stands within the proposed project area that provide sapsucker habitat. Almost all aspen stands observed are in the early to mid seral stages, and do not need to be regenerated. Sapsucker surveys have not been conducted within the planning area; however, both red-naped and red-breasted sapsuckers, as well as hybrids, have been noted in other locations on the Bly Ranger District, and it is presumed that they would occur in this project area as well.

Environmental Consequences

Effects Common to Alternatives 2 and 3

Red-naped sapsuckers would benefit from aspen enhancement work and improved foraging conditions. This species could be negatively affected if snags are removed for safety reasons (danger trees) or burned during prescribed burning, resulting in a loss of nesting habitat. Prescribed burning may both decrease snags and create snags that would provide nesting habitat. This is a short term negative impact to habitat because habitat would still be provided over the long term.

Closing and decommissioning roads would reduce disturbance of wildlife species, decrease human activities and promote habitat and its connectivity. Construction of temporary roads would increase human traffic and disturbances short term, and it is possible that a tree with an active cavity nest could be felled and individuals could be harmed if birds are present when the tree is cut. Human disturbance would temporarily increase during project activities, but in the long-term road densities would be reduced throughout the project area.

It is expected that most aspen stands would receive some form of treatment as needed to increase vigor and retention. An unknown number of red-naped sapsuckers would be affected by implementation of the proposed project.

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the Forest scale. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of red-naped sapsuckers is expected on the Fremont National Forest.

Existing Condition/Affected Environment

Pileated Woodpeckers

Pileated woodpeckers are the largest woodpeckers in North America (with the exception of the Ivory billed Woodpecker) and are closely association with old growth conifer forests. Of the woodpeckers, the pileated is the most likely to be affected by timber management practices due to its large size and resultant need for large dead trees for nesting, large hollow trees for roosting, and dead woody material for foraging (Bull et. al. 1986). Pileated woodpeckers can breed in younger forests if they contain some larger trees (http://birdweb.org/birdweb/bird details.aspx?value=search&id=280). In northeast Oregon, home ranges averaged 1,005 acres for a pair followed 5-10 months (Bull and Holthausen.1993). Pileated woodpeckers are also responsible for creating nest holes for numerous large secondary cavity nesters. Approximately 90% of the diet

of these birds consists of carpenter ants, which are associated with large standing and downed wood. Pileated woodpeckers will also eat other insects and to a lesser extent, fruit and nuts (http://www.mbr-pwrc.usgs.gov/id/framlst/Idtips/h4050id.html, http://birdweb.org/birdweb/bird details.aspx?value=search&id=280).

Based on the amount and size of snags and down wood in the planning area, there is a substantial amount of habitat within the Black Hills planning area. No formal pileated woodpecker surveys have been conducted in the planning area, but they have been observed within the planning area.

Environmental Consequences

Effects Common to Alternatives 2 and 3

Reduced stand densities may negatively affect pileated woodpeckers. As the health of the forested stands improves, fewer snags would be created through natural processes. However, this affect on foraging and nesting habitats would not be inconsistent with historical conditions. Ecological processes would continue to function, and future snags would be provided for within the project area (see Appendix C for additional information related to snags and down wood). Untreated areas within units greater than 20 acres, areas not treated during this project, and the treated stands themselves would all continue to provide for current and future snags. Prescribed burning may both decrease snags and create snags that would provide nesting habitat. This is a short term negative impact to habitat because habitat would still be provided over the long term.

Closing and decommissioning roads would reduce disturbance of wildlife species, decrease human activities and promote habitat and its connectivity. Construction of temporary roads would increase human traffic and disturbances short term, and it is possible that a tree with an active cavity nest could be felled and individuals could be harmed if birds are present when the tree is cut. Human disturbance would temporarily increase during project activities, but in the long-term road densities would be reduced throughout the project area.

It is expected that most conifer stands would receive some thinning or prescribed fire. An unknown number of pileated woodpeckers would be affected by implementation of the proposed project.

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the Forest scale. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of pileated woodpeckers is expected on the Fremont National Forest.

Existing Condition/Affected Environment

Black-backed Woodpeckers

Numerous authors have associated black-backed woodpeckers with disturbances, such as fire or insect outbreaks, which provide a large number of dead and dying trees (Bock and Bock, 1974; Marshall 1992; Raphael and White 1984). Black-backed woodpeckers are associated with mature and over-mature forested stands that have a high incidence of disease, decay, and mortality (Goggans et al. 1988). They are an irruptive species, meaning they respond to local, temporary, abundance of food as a result of wind, fire, or insect-killed timber that support bark beetles in above normal numbers (Marshall 1992). Black-backed woodpeckers are often dependent upon stand-

replacement wildfires occurring on the landscape despite the fact that their use of a recently burned forest may be short-term (1-3 years) (Sallabanks and Mclver 1998).

Black-backed woodpeckers often nest low in a tree; both living and dead trees are used, but may require heart rot for excavation of nest cavities. Nest trees are often smaller in diameter than those used by other cavity nesters (Raphael and White 1984, Hejl et al. 2000). Salvage-logged burned forests contain fewer nests than un-logged burns (Hejl et al 2000). Black-backed woodpeckers forage on trees that generally have been dead for less then three years by "scaling" or prying off layers of bark to get at the insects. Little use of downed material has been observed.

The planning area currently provides foraging and nesting habitat for black-backed woodpeckers; this is based on field observations of recently dead and dying trees that would provide habitat for this species. Surveys have not been conducted for black-backed woodpeckers within the planning area; however, there have been incidental sightings.

Environmental Consequences

Effects Common to Alternatives 2 and 3

Black-backed woodpeckers rely on snags for foraging and nesting (Marshall et al. 2003). Thinning stands would result in fewer snags being created through natural processes such as fire and beetle kills. Trees would continue to die within the subwatersheds but at a slower rate that is consistent with historical conditions (see Appendix C for additional information related to snags and down wood). Prescribed burning may both decrease snags and create snags that would provide nesting habitat. This is a short term negative impact to habitat because habitat would still be provided over the long term.

Closing and decommissioning roads would reduce disturbance of wildlife species, decrease human activities and promote habitat and its connectivity. Construction of temporary roads would increase human traffic and disturbances short term, and it is possible that a tree with an active cavity nest could be felled and individuals could be harmed if birds are present when the tree is cut. Human disturbance would temporarily increase during project activities, but in the long-term road densities would be reduced throughout the project area.

It is expected that most conifer stands would receive some thinning or prescribed fire. An unknown number of black-backed woodpeckers would be affected by implementation of the proposed project.

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the Forest scale. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of black-backed woodpeckers is expected on the Fremont National Forest.

Under Alternative 3 there would be no treatment in “managed” old growth lodgepole pine stands, which are designated for black-backed woodpeckers. With no treatment in managed lodgepole old growth stands, these stands will continue to function as a single seral stage, and when they are impacted by fire or insect infestations (as is currently happening in lodgepole stands), it will take

substantially longer for there to be any managed old growth lodgepole. This could make it take approximately an extra 20-30 years before any lodgepole in the managed old growth stands truly becomes old growth. This alternative would not have any short term negative effects on habitat for black-backed woodpeckers; however, there would be a long term decrease and habitat would take longer to develop.

Cumulative Effects for all Primary Cavity Excavator Species

Past activities in the planning area including commercial timber harvest, non-commercial thinning, fire suppression, wildfire, road construction, firewood collection, and livestock grazing, have likely changed conditions in this area. Habitat for primary excavators/snag and downed wood dependent species has been modified within these subwatersheds. Species that prefer dense conditions such as the hermit thrush and other ground nesting birds (Marshall et al 2003) have likely increased, and species that prefer more open forests such as the white-headed woodpecker, flammulated owl, chipping sparrow, and pygmy nuthatch (Marshall et al 2003) have likely decreased. It has been over 20 years since activities such as timber harvest, road building and prescribed fire took place in the Black Hills Project area. The residual impacts from these activities that could have a cumulative effect on primary cavity excavators when considered along with the potential effects of the Black Hills Project are minimal. Ongoing livestock grazing is not expected to contribute to cumulative effects on primary cavity excavators. Fire suppression has increased foraging habitat for black-backed woodpeckers, however it has also decreased habitat for red-naped sapsuckers. Ongoing firewood gathering would result in some loss of snags, primarily small to medium sized lodgepole pine. When considered with the proposed actions of Alternatives 2 or 3, the cumulative effect would be minor, because only a minimal number of snags would be removed due to safety issues under the action alternatives and the largest and oldest trees along with other green trees would be retained to provide for snags and large down wood into the future. Overall, the project is expected to result in insignificant (minimal) cumulative effects to primary cavity excavator species or their habitat in combination with past projects, a small short- or long-term species population decrease may occur. While some additive effects may be anticipated, the project is consistent with the Forest Plan.

Existing Condition/Affected Environment

Other MIS Species

Northern Goshawk

The northern goshawk is the largest North American accipiter and is associated with mature and late and old structure stage (LOS) ponderosa pine and mixed conifer forest structural stages for nesting. The goshawk's home range encompasses about 6,000 acres and is composed of a nest core area, post-fledging area (PFA), and a foraging area. Various forest structural stages are associated with the components of the home range. Fire exclusion has allowed a buildup of heavy shrub layers, together with timber harvest, has likely made former foraging and nesting areas unusable, but no population declines have been documented (Marshall et al 2003). Nest areas often occur on north aspects, along stream zones or other areas where a dense forest canopy and LOS forest conditions are present. Desimone (1997) found that re-occupancy of nest sites in the Fremont National Forest was clearly related to the amount of mid-aged and late structural forest stages having >50% canopy closure. Post-fledging areas usually resemble the nest area, but also include a variety of forest types

and conditions where hiding cover (for the young) and prey availability is present (Reynolds et. al. 1991).

Goshawks are opportunistic, eating a wide variety of prey. Squirrels, snowshoe hares, grouse, corvids, woodpeckers, and other medium to large songbirds are all potential prey. Goshawks approach their prey stealthily until it is close enough to overcome its prey in mid-air with a burst of speed, or drop out of a tree and swoop down on ground dwelling prey. Once they have their prey they take it to a perch and pluck the feathers or hair (http://birdweb.org/birdweb/bird details.aspx?value=search&id=102). Foraging areas may be as closely tied to prey availability as to habitat structure and composition. These areas often contain a mixture of various forest structural stages with snags, downed logs, large trees, and small openings with herbaceous and/or shrubby understory present (Marshall et al 2003).

The Fremont Forest Plan (1989, as amended) standards and guidelines for goshawks are to protect a 30 acre nest core, and to delineate a 400-acre post fledging area (PFA) with an emphasis of maintaining existing late and old structural (LOS) stands and enhancing younger stands towards LOS condition.

Goshawk surveys were conducted within the planning area during the 2006 and 2007 field seasons and no goshawk nests were located. Two goshawks were heard, but neither they nor their nests could be located. There were also two incidental sightings, but follow-up visits in those areas did not locate the birds or a nest. Based on the size of the project area, there may be nesting goshawks in the proposed project area, but they have not been located. The Forest Plan identifies that if any raptor nest is discovered within ¼ mile of a work site, work shall cease and the wildlife biologist contacted.

Environmental Consequences

Effects Common to Alternatives 2 and 3

Thinning as proposed for this project would reduce stand densities and would provide for greater assurance of stand health and retention over time. This would also move stands towards the historical conditions of open ponderosa pine stands as recommended in the Watershed Analysis. The temporary increase in human disturbance may contribute to altering movement patterns and habitat use but the established operating periods based on nesting and fledging would prevent disturbance to any discovered nest cores and the ¼ mile buffer around them. Desimone (1997) found that re-occupancy of nest sites in the Fremont National Forest was clearly related to the amount of mid-aged and late structural forest stages having >50% canopy closure. A design feature of this project is to retain 5-15% of each unit in untreated patches. This would contribute to diversity within stands, and be beneficial in providing denser patches that would contribute to goshawk habitat across the landscape. Alternative 3 would provide more untreated stands that may be beneficial for providing additional areas of diversity for nesting and foraging for goshawks.

Prescribed burning may both decrease stand densities and increase stand diversity by creating snags and patchiness both for conifer and shrub vegetation. This is expected to be a short term negative impact to habitat, however, suitable habitat would still be provided over the long term.

Closing and decommissioning roads would reduce disturbance of wildlife species, decrease human activities and promote habitat and its connectivity. Construction of temporary roads would increase human traffic and disturbances, and it is possible that a tree with a cavity nest could be felled and individuals could be harmed if the nest was active when the tree was cut. Opening temporary roads would temporarily increase human disturbance, but in the long-term, road densities would be reduced throughout the project area.

It is expected that most conifer stands would receive some thinning or prescribed fire. It is estimated that up to 10 pairs of goshawks may be affected by implementation of the project; however, there have only been four individuals or pairs observed or heard in the project area during surveys.

Because this project impacts a small percentage of suitable goshawk habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the scale of the Forest. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of goshawks is expected on the Fremont National Forest.

Cumulative Effects

Past management activities in the subwatersheds have altered some habitat for goshawks. Past timber harvest has modified, removed or degraded what would have been foraging or nesting habitat for goshawk (Marshall et al., 2003). Nest re-occupancy by goshawks on the Fremont National Forest is related to the amount of mid-aged and late structural forest stages having greater than 50% canopy closure (Desimone 1997).

Because this project is expected to result in insignificant (minimal) cumulative effects to species habitat or risks to species in combination with past projects, a small short- or long-term species population decrease may occur. While some additive effects may be anticipated, the project would be consistent with the Forest Plan.

Existing Condition/Affected Environment

American Marten

American marten habitat is characterized by dense (60 –100% canopy closure), multi-storied, multi-species late seral coniferous forests with a high number of large (> 24" dbh) snags and down logs (Freel 1991). Habitat is generally within ½ mile of dense riparian corridors used as travelways and has an interspersion of small (< 1-2 acres) openings for foraging. They also require forested travel corridors for maintaining links among individuals and populations (Witmer et al. 1998). Martens particularly select forests with complex physical structure near the ground (Ruggiero et. al. 1994) that provides thermoneutral resting sites and access to subnivian prey (Chapin, 1997). Diets include bird eggs and nestlings, insects, fish, shrews, deer mice, red squirrels, heather voles, northern flying squirrels, and Douglas squirrels (Witmer et al. 1998, Ruggiero et al 1994). Large openings are avoided due to their susceptibility to predators and the lack of forest structure for maintenance of prey species.

Optimal habitat includes a home range of 1,900 acres which includes mature stands that are >120 acres, >70% canopy closure, >3 snags per acre in resting/denning and foraging habitat, >9 live tree snag replacements, and >20 down logs per acre. Travel corridors should provide 60-80% canopy

closure and >300 feet within mature stands or >600 feet when there are adjacent openings. Martens generally do not occur in landscapes where more than one-third of the landscape is open (Chapin et al. 1998, Hargis et al.1999, Payer 1999, Potvin et al. 2000).

There are no known marten sightings within or adjacent to the proposed project area. General reconnaissance of the proposed project area resulted in no marten sightings; however, they are expected to occur where suitable habitat is present.

Environmental Consequences

Effects Common to Alternatives 2 and 3

Thinning and fuel reduction treatments would increase human disturbance in the area, and it would modify and remove vegetation that contributes to habitat for marten. However, it would also be moving the vegetation toward historical conditions that are more sustainable. This may negatively affect marten and their habitat. The project would alter habitat suitability during the time of increased human activity. Retaining the majority of snags and down wood should provide sufficient habitat components along with untreated areas. Prescribed fire treatments would reduce the potential for a stand replacing fire, which could reduce existing down wood and snag densities that contribute to marten habitat components while at the same time it could create additional snags and down wood by killing trees. When considered from current conditions, this would negatively affect marten and prey species habitat; however, it would be moving the vegetation towards historical conditions that are more sustainable and resilient, and would still provide marten habitat. Alternative 3 would treat fewer acres, and provide denser stands that would be beneficial for martens.

It is estimated that the proposed project could affect up to 10 pairs of martens and their habitat.

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would result in a small negative trend of habitat from increased disturbance and habitat modification. The loss of habitat would be insignificant at the scale of the Forest. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of American Marten is expected on the Fremont National Forest.

Cumulative Effects

Past timber harvest and road construction has contributed to habitat fragmentation and has likely affected marten natal and maternal dens. When sufficient downed wood and snags are not left on the ground, habitat components for marten are not provided for the species and for their prey (Ruggiero et al., 1994, Campbell 1979).

Because this project is expected to result in insignificant (minimal) cumulative effects to species habitat or risks to species in combination with past projects, a small short- or long-term species population decrease may occur. While some additive effects may be anticipated, the project would be consistent with the Forest Plan.

Existing Condition/Affected Environment

Mule Deer

Mule deer habitat is generally described as a mix of hiding, thermal, fawning cover, and foraging

habitat. The optimum mix of cover should be 40-50% of the available habitat with 20% in hiding cover, 10% in thermal cover, 5% in fawning cover, and the remaining 5-15% in either hiding, thermal or fawning cover. Standards and guidelines in the Forest Plan (1989, as amended) require a minimum of 30% cover. A number of factors including road density, distance between sources of water, forage utilization by cattle and the amount and arrangement of cover and forage patches affect habitat use by mule deer. Optimal conditions for these factors are those values as defined in Bienz, et al (1985), Thomas (1979), and others where no affect on habitat use is anticipated. These include road density – 1.4 mi/sq. mi; distance between water sources - 2.8 mi; forage utilization by cattle - 10-24%; cover - 40-50%; arrangement of cover and forage – optimal use within 600 feet of a cover or forage patch.

Mule deer in central Oregon are a migratory group of animals that roam a vast mountainous summer range and crowd into relatively small winter ranges (Dealy 1971). Mule deer are not believed to have been abundant prior to 1850 in this region, and remained at low numbers through the early 1900's (Peek et al. 1999). Mule deer began to increase around 1915, probably because of increased shrublands (Salwasser 1979, Peek et al. 1999). Shrublands have since continued to mature across the western ranges (Urness 1990, Peek et al. 1999) and this is the case throughout much of the planning area. Public interest and use have initiated management of mule deer populations that are higher than historical numbers.

The following mule deer habitat factors are important within the planning area:

1) Cover

Mule deer find lower ambient temperatures under thermal cover in hot weather and warmer temperatures in cold weather. Wind velocity is greatly reduced and snow depth and condition are more favorable to animal movement in cover stands. All these factors combined can reduce energy loss by mule deer (Peek, et al. 1982). Summer thermal cover minimizes metabolic and time costs associated with heat dissipation. Lost foraging time or the energetic costs of increasing metabolism can translate into decreased summer weight gains (Demarchi and Bunnell 1993). Thermal cover can also be provided by shrubs, juniper woodlands, or physical objects such as boulders and ledges (Peek et al 1982). Mule deer are as likely to bed in the shade of a single conifer, rock outcrop, or cut-bank in the midday, as in high canopy closures (Gay 1998).

Hiding cover is used for escape and protection from predators and humans (Peek et al. 1982). Although under current management, optimal habitat is defined as that which is within 600 feet of cover (cover being defined as a stand that is at least 60% cover), Gay did not find concentrated deer use within 600 feet of hiding cover (1998). Although the Fremont Forest Plan (1989, as amended) requires the Forest Service to manage by using the current definition of hiding cover (a stand in which >60% of the area can hide 90% of a deer at 200 feet), this omits less dense vegetation types which deer also recognize as cover (Gay 1998).

2) Grass and Forbs

Actual usage of grass and forbs by mule deer is difficult to determine because microhistological analysis is not credible because of near complete digestion of new and rapidly growing grasses and forbs (Zyzner and Urness 1969, Gay 1998). Grasses and forbs compose the bulk of spring diets. Gay's studies found that in April and May of 1995, when there was no snow cover and an abundance of new grasses and forbs, deer were seldom seen feeding on anything other than new herbaceous

growth (1998). Forbs especially showed high use with 25-44% in June and July and 15-57% in August and September (Gay 1998).

Fire may affect the forage resources by changing both forage quality and quantity (Bunting 1998). Forage characteristics that may be affected by fire include protein, phosphorus, fiber content, and subsequent changes in digestibility (Bunting 1998). Cook found substantial increases in crude protein of herbs after burning (1994). Fire-stimulated flowering is another phenomenon which increases seedling abundance in burned areas, as Walstad found increased flowering and seed vigor following fire for grasses in the pine forests and high desert regions east of the Cascades (1990). Small burned areas may also be more heavily utilized by herbivores than large areas because of the concentration of palatable re-growing forage (Bunting 1998).

Approximately 2,713 acres of designated mule deer winter range (MA 1) occurs on National Forest System land in the project area. The remainder of the area is recognized as mule deer summer range (MA 5) in the Forest Plan. Plantations, riparian areas, and dense stands provide hiding, thermal, and fawning cover. Based on observations, the area within the proposed project boundary meets the 30% cover standard and guideline (this is more than just hiding cover). There are pockets of vegetation within all of the stands that provide hiding cover; however, entire stands often do not meet the 60% of the stand requirement to provide hiding cover. Mule deer populations have increased from pre-settlement times, but populations have declined from the high numbers experienced during the mid to late twentieth century.

Forest Plan objectives for open road densities across the Forest are 2.5 mi/mi^2 or less on summer range and 1.0 mi/mi^2 or less on winter range during the winter months. Current road densities in this planning area exceed Forest Plan goals on Forest Service lands as shown in Table 3-22 below. It is recognized that some roads may have self closed from a lack of use, but it is also true that there are roads on the ground that are not a part of the planned transportation system.

Table 3-22. Current Road Density by Subwatershed within the Black Hills Project area.

Subwatershed	Current Total Road Density mi/mi^2
Sycan River	5.71
Marsh Reservoir	6.06
Snake River	4.33

Oregon Department of Fish and Wildlife's current deer management population objective for the Interstate unit is 14,480 deer and the current estimate is that the deer herd is at approximately 50% of management objectives. The buck/doe ratio objective is 15/100. Post hunting season in 2006 the buck/doe ratio was 20/100. The population has been holding steady to slightly increasing during the last several years (Foster, pers. comm. 2007).

Environmental Consequences

Effects Common to Alternatives 2 and 3

Thinning prescriptions throughout the project area would open up canopy closures and allow for increases in browse and forage production. Alternative 3 would do this to a lesser extent. Aspen stands would be improved by removing encroaching conifers less than twenty-one inches in diameter. The proposed activities would not affect hiding cover because most stands as a whole do not meet the definition of hiding cover, but pockets within them do. Some brush would be removed while implementing prescribed fire (40-60% of the burned area would actually burn); however, this brush would regenerate with improved browse for deer and likely return to original size or become larger within 5-10 years due to decreased competition. Bitterbrush in mule deer winter range (MA1) would be managed to retain at least 34% untreated, and treat up to 66% to provide seral stage diversity and improve forage. Retention of 5-15% of untreated areas in units greater than 20 acres and the areas not being treated by this project would provide increased habitat diversity for deer. Aspen treatments would improve fawning and hiding cover, and mountain mahogany treatments would improve forage for deer. Alternative 3 would do this to a lesser extent. The alternatives as proposed would move towards implementing the recommendations in the watershed analysis for mule deer. Those being to retain some dense patches for hiding and thermal cover, improve forage, and decrease road densities.

Road densities would be reduced within the proposed project area with the selection of Alternative 2 or 3 (see Transportation/Roads section). Closing and obliterating roads in the project area would benefit deer by reducing human presence in some areas and by promoting desirable habitat and its connectivity.

Because this project impacts a small percentage of suitable habitat across the Forest, the overall direct, indirect, and cumulative effects would be a minor negative effect from increased disturbance. The short term disturbance of habitat would be insignificant at the scale of the Forest. It is expected that the overall long-term effect would be improved habitat and increased population. The Black Hills Project is consistent with the Forest Plan, and thus continued viability of mule deer is expected on the Fremont National Forest.

Cumulative Effects

Past timber harvest, road building and prescribed fire took place in the Black Hills Project area over 20 years ago. Ongoing activities such as livestock grazing, fire suppression and firewood gathering are not expected to contribute to cumulative effects. There are not any known foreseeable future actions in the area of the project. Implementation of Alternative 2 or 3 would bring the area back within the Historic Range of Variability. With implementation of Forest Plan standards and guidelines, this project would help to create habitat, at historical levels and densities, for mule deer.

Because the project is expected to result in insignificant (minimal) cumulative effects to mule deer or its habitat, a small short- or long-term species population increase may occur.

Neotropical Migratory Birds and Songbirds

Neotropical migratory birds are those that breed in the United States and winter south of the border in Central or South America. They include a large group of species, including many hawks, shorebirds, warblers, and other song birds, with diverse habitat needs spanning nearly all successional stages of most plant community types (Niles 1992). Nationwide declines in population trends for neotropical migrants have developed into an international concern.

The planning area provides a variety of habitat for these species. For most of these species, habitat restoration would occur under the action alternatives. These alternatives would move the vegetation within the subwatersheds towards historical conditions; although Alternative 3 would do this to a lesser extent. However, Lewis's woodpecker and olive sided flycatcher would benefit the most from Alternative 1 because they benefit from large stand-replacing fires. However, under the action alternatives, there would continue to be small patches that die-out due to pathogens or small isolated fires, which would continue to provide habitat.

Partners in Flight Focal Species

The Partners in Flight Focal Species with habitat in the three subwatersheds are listed in Table 3-23 below. Landbird conservation in ponderosa pine forest emphasizes maintaining healthy ecosystems through representative focal species for four habitat conditions. These include large patches of old forest with large snags, large trees, and open understory with regenerating pines, and patches of burned old forest.

For most of these species, habitat restoration would occur under the action alternatives. These alternatives would move the vegetation within the subwatersheds more towards its historical conditions. However, for Lewis's woodpecker and olive sided flycatcher, Alternative 1, the No Action alternative, would provide the greatest amount of habitat if/when a stand replacing fire occurs. However, even under the action alternatives, there would continue to be small patches and single trees that die-out due to pathogens or small isolated fires, which would continue to provide habitat. Alternative 3 would treat fewer acres, and therefore, provide additional areas of denser vegetation. Therefore the effects of moving the vegetation towards more open stand conditions would not be as pronounced.

Table 3-23. Species identified for the subprovince Central Oregon/Klamath Basin in the "*Conservation Strategy for Landbirds of the East-slope of the Cascade Mountains in Oregon and Washington*" (Altman 2000) that may be found within the Black Hills Project area

Species	Representative of:
White-headed Woodpecker	Ponderosa Pine – large patches of old forest with large snags
Pygmy Nuthatch	Ponderosa Pine – large trees
Chipping Sparrow	Ponderosa Pine – open understory with regenerating pines
Lewis' Woodpecker	Ponderosa Pine – patches of burned old Forest
Sandhill Crane	Meadows
Red-naped Sapsucker	Aspen
Brown Creeper	Mixed conifer (Late Successional)-large trees
Williamson's Sapsucker	Mixed conifer (Late Successional)-large snags
Flammulated Owl	Mixed conifer (Late Successional)-interspersion grassy openings and dense thickets
Hermit Thrush	Mixed conifer (Late Successional)- multi-layered/dense canopy
Olive-sided Flycatcher	Mixed conifer (Late Successional)- edges and openings created by wildfire

Birds of Conservation Concern

Below is the list of Birds of Conservation of Concern from the U.S. Fish and Wildlife Service (2002). Some of these species do not occur in the three subwatersheds, and some have been addressed above in other sections (and are shown in **bold** below), or have been identified as not being present and not having habitat present. These species were considered in the design of the proposed project.

Swainson's Hawk
Ferruginous Hawk
Golden Eagle
Peregrine Falcon
Prairie Falcon
Yellow Rail
American Golden-Plover
Snowy Plover
American Avocet
Solitary Sandpiper
Whimbrel
Long-billed Curlew
Marbled Godwit
Sanderling
Wilson's Phalarope
Yellow-billed Cuckoo
Flammulated Owl
Burrowing Owl
Black Swift
Lewis' Woodpecker
Williamson's Sapsucker
White-headed Woodpecker
Loggerhead Shrike
Gray Vireo
Virginia's Warbler
Brewer's Sparrow
Sage Sparrow
Tricolored Blackbird
Greater Sage Grouse (Columbia Basin population)

Threatened, Endangered and Sensitive Plants

Introduction

To improve conciseness, this EA summarizes and references information that is available in greater detail in a tabular format Biological Evaluation (BE) in the project record. The BE contains a 13-page table, which displays species name (common and scientific), range, local habitats, presence of suitable or occupied habitat in the planning area and a summary of effects for 73 different vascular plants, bryophytes, fungi or lichens with suspected or documented habitat on the Fremont-Winema National Forest.

Existing Condition/Affected Environment

Federally Listed Threatened, Endangered, or Candidate Plant Species
Documented or suspected habitat for federally listed Threatened, Endangered, or Candidate plant species does not occur on the Fremont-Winema National Forest.

Sensitive Vascular Plants
Of the known Region 6 (R6) Sensitive Species that are documented or suspected to occur on the Fremont-Winema National Forest, four sensitive plant species, *Carex abrupt, Carex capitata, Carex lasiocarpa* var. *americana* and *Eleocharis bolanderi*, have potential habitat within the project area.

There are approximately 390 acres of potential habitat for *Carex abrupt, Carex capitata,* and *Carex lasiocarpa* var. *americana.* These species occur in moist meadows and wetlands. *Carex abrupta* has not been found on the Fremont-Winema NFs to date. The nearest known site of *Carex capitata* is at Sycan Marsh, about 14 miles north of the project area. The nearest known sites of *Carex lasiocarpa* var. a*mericana* is on the Klamath District, approximately 39 miles west of the project area.

There are approximately 4,015 acres of suitable habitat for *Eleocharis bolanderi.* This species occurs in open seasonally moist meadows, drainages, and scablands. *Eleocharis bolanderi* has been documented on Chiloquin District, approximately 11 miles south of the project area, where it was found at sites of a previous Region 6 sensitive plant species, *Calochortus longebarbatus longebarbatus. Calochortus longebarbatus longebarbatus* has been found within the project area, increasing the potential for *Eleocharis bolanderi* to occur.

Sensitive Bryophytes and Lichens
The project area lacks suitable habitat, or is outside the range of sensitive bryophytes and lichens. There are no known sites of these species within or adjacent to the project area.

Sensitive Fungi
Gomphus bonarii, *Gyromitra californica*, *Leucogaster citrinus,* and *Hyprophorus caeruleus* have been found in white fir mixed conifer stands on the Fremont-Winema and have approximately 7,800 acres of suitable habitat in the project area. To date, predisturbance, random grid, purposive, and general surveys conducted on several thousand acres across the Fremont-Winema during 1999 -2010 have located no more than 1-14 sites of each of these species. Documented sites of *Gomphus bonarii* and *Gyromitra californica* were found 37 miles away on the Klamath Ranger District.

Gyromitra californica is a saprobe, thought to be associated with well-decayed woody debris. Most sites on the Forest have been located in mixed conifer riparian areas on Klamath District. *Gomphus bonarii* and *Hygrophorus caeruleus* are mycorrhizal potentially associated with true fir and pine species. *Hygrophorous caeruleus* was found to be more abundant and widespread on the forests than previously thought, after late spring rains in May-June 2009. One documented site of *Hygrophorous caeruleus* was found 15 miles south of the project area on the Bly Ranger District and 16 miles north on the Silver Lake Ranger District. *Leucogaster citrinus* is endemic to the Pacific Northwest, known from western Washington, western Oregon and northern California. It is generally found on the Winema side of the forest, with one documented site 24 miles southeast of the project area on the Bly Ranger District.

Environmental Consequences

Alternative 1 – No Action

The No Action Alternative would leave the proposed activity area in its current state. Ongoing management practices (such as road maintenance, fire suppression, and personal use firewood cutting) would continue.

Sensitive Vascular Plants

Alternative 1 would have no ground-disturbing effects on sensitive plant species with suitable habitat within the project area.

Carex abrupt, Carex capitata, and *Carex lasiocarpa* var. a*mericana* occur in moist meadows and wetlands. Without proposed vegetation management activities, moist meadows and wetlands will eventually be reduced in size by conifer encroachment, thus reducing suitable habitat for these species.

Eleocharis bolanderi species occurs in open seasonally moist meadows, drainages, and scablands. Without proposed vegetation management activities, the seasonally moist meadows, drainages, and scablands would eventually be reduced in size by conifer encroachment as well. This would reduce the suitable habitat available for this species.

Sensitive Bryophytes and Lichens

Alternative 1 will have no impact on sensitive bryophytes and lichens. The project area has no suitable habitat or is outside the range of these species, and there are no known sites of these species in the project area.

Sensitive Fungi

The No Action alternative would have no impact on *Gomphus bonarii, Gyromitra californica, Leucogaster citrinus,* or *Hygrophorus caeruleus*.

Alternative 1 would have no effect on the remaining plants and fungi on the R6 list (see Table 2 in the BE); these species are considered unlikely to occur in the project area.

Effects Common to Alternatives 2 and 3

Activities such as tree felling, skidding, construction of landings and temporary roads, machine piling, burning, and/or mechanical fuel treatments may cause ground disturbance in potential sensitive plant habitat. Because the amount of land proposed for thinning is less extensive in Alternative 3, ground disturbance would be less than under Alternative 2. Soil disturbance would be limited by the Project Design and Resource Protection Measures described in Chapter 2, including BMP's. These restrict use of mechanical equipment in streamside buffers, scablands, meadows, wetlands, and on steep slopes (>35 percent); require soils to be sufficiently dry before entry; and limit skid trail placement and density.

Sensitive Vascular Plants

Carex abrupt, Carex capitata, and *Carex lasiocarpa* var. a*mericana* are not known to occur in the project area, but could be present in moist-wet meadow habitat. Proposed thinning would occur around the edges, but would not occur in meadow habitats. Removal of encroaching trees could potentially help maintain habitat for *Carex capitata, Carex capitata,* and *Carex lasiocarpa* var. a*mericana* over the long term. Meadows are one of the features that will be protected on the sale area map (BMP T-4), and mechanical equipment is restricted from entry into meadows.

The action alternatives propose burning within some meadow areas as needed to reduce slash and revitalize ground vegetation. Most *Carex* species are well adapted to survive fire because of their growth form and, in most cases, their habitat (Wilson et. al., 2008). The foliage may burn, but the growing points are protected below the surface (Wilson et. al., 2008). Many *Carex* species have long-lived seed banks that will contribute to revegetation after a fire (Wilson et. al., 2008). *Carex* survival is greater after low-intensity fire than after high-intensity fire, with the intensity being graded at the rhizome level (Wilson et. al., 2008). *Carex abrupt, Carex capitata,* and *Carex lasiocarpa* var. a*mericana* would survive a low-intensity fire well and may even benefit. Based on the above factors, Alternatives 2 and 3 may impact individuals or habitat of these three species, but is not likely to cause a loss of viability of the population, or the species as a whole, or cause a trend toward Federal listing (MIIH).

Eleocharis bolanderi is not known to occur in the project area, but habitat is present in open, seasonally moist meadows, drainages, and scablands. Proposed tree thinning could occur around the edges, but would not occur within the meadow or scabflat habitats. Meadows and scablands are features that will be protected on the sale area map (BMP T-4), and mechanical equipment is restricted from entry into meadow and scabland habitat.

Prescribed burning may occur within suitable *Eleocharis bolanderi* habitat. *Eleocharis bolanderi* is a rhizomatous perennial that should respond favorably to a low-intensity fire by sprouting from rhizomes. Based on these factors, Alternatives 2 and 3 may impact individuals or habitat of *Eleocharis bolanderi*, but is not likely to cause a loss of viability of the population, or the species as a whole, or cause a trend toward Federal listing (MIIH).

Sensitive Bryophytes and Lichens

Alternatives 2 and 3 will have no impact on sensitive bryophytes and lichens. The project area has no suitable habitat or is outside the range of these species, and there are no known sites of these species in the project area.

Sensitive Fungi

Gomphus bonari, Gyromitra californica, Leucogaster citrinus, or *Hygrophorus caeruleus* are not known to occur in the project area but could be present in mixed conifer forest. These species are most often found in old growth habitat, and would likely occur in stands that had relatively high canopy closure. In these types of areas, proposed thinning and proposed fuel activities (mechanical or prescribed burning) could be intensive, and the ground disturbance associated with these activities would likely impact fungi mycelia negatively. Alternatives 2 and 3 could result in a decline in habitat quality, due to loss of host trees, loss of shade, and drier conditions. Because these fungi are rare and unlikely to occur in the project area, the potential for them to be impacted by the action alternatives is low.

Alternatives 2 and 3 also propose the use of Borax. Borax is a preventative measure against a fungal root rot in pine and white fir stumps. Borax has only a minimal potential to impact fungi on the sensitive plant list because it will be applied as a powder directly to cut stumps. The potential loss of suitable habitat through fuels reduction treatments discussed above would have more impact than the use of borax on fungi on the sensitive plant list. Based on these factors, the action alternatives, may impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species (MIIH).

Cumulative Effects

Past, Present, and Future Foreseeable Activities

The primary past, ongoing, and foreseeable future activities with potential to affect sensitive plant and invasive plant populations in the project area include road construction, timber harvest and other vegetation management activities (including prescribed fire), livestock grazing, recreation, and invasive plant management.

Sensitive Vascular Plants

There is no information about the abundance and distribution of *Carex abrupt, Carex capitata,* and *Carex lasiocarpa* var. a*mericana* in the project area, and no sites are known to occur. The most likely past, ongoing, and foreseeable future activity with potential to affect *Carex abrupt, Carex capitata,* and *Carex lasiocarpa* var. a*mericana* would be livestock grazing. These three species may be palatable to livestock, and if not, would occur in meadows or around the edges of water bodies with other graminoids where incidental grazing and trampling could occur. If livestock concentrate in occupied habitat, this species could experience negative impacts. The effects of temporary road construction, timber harvest and other vegetation management activities, recreation, and invasive plant management would likely be minor.

There is no information about the abundance and distribution of *Eleocharis bolanderi* in the project area, and no sites are known to occur. Vegetation management projects, including timber sales and fuels treatments, would have been minor in these types of habitats. Juniper or lodgepole pine removal may have occurred in some areas. Removal of encroaching trees would likely improve habitat for *Eleocharis bolanderi.* The species may also be affected by grazing. The species is not likely to be palatable to livestock, but may be impacted by trampling, particularly in meadow habitats. The effects of temporary road construction, recreation, and invasive plant management would likely be minor.

Alternatives 2 and 3 would affect approximately 50% of the potential habitat for *Carex abrupt, Carex capitata,* and *Carex lasiocarpa* var. a*mericana* and approximately 73% of potential habitat for *Eleocharis bolanderi* in/adjacent to the project area. These species occur in open habitats where little treatment is likely to occur. Cumulative effects to these species would be minor.

Sensitive Fungi

There is no information about the abundance and distribution of *Gomphus bonari, Gyromitra californica, Leucogaster citrinus,* or *Hygrophorus caeruleus* in the project area, and no sites are known to occur. Many years ago, vegetation management projects, including timber sales and fuels treatments, may have occurred in habitat for these fungi. The ground disturbance caused by these activities would likely have had a negative effect. Canopy opening caused by these activities may also have negatively impacted habitat for *Gomphus bonari, Gyromitra californica, Leucogaster citrinus,* or *Hygrophorus caeruleus.* The effects of temporary road construction, livestock grazing, recreation, and invasive plant management would likely be minor.

Alternatives 2 and 3 would affect approximately 50% of the potential habitat for *Gomphus bonari, Gyromitra californica, Leucogaster citrinus,* or *Hygrophorus caeruleus* in/adjacent to the project area. These species are not known to occur in the project area, and the potential for them to occur is low. The potential for Alternative 2 and 3 to contribute to cumulative effects on these species is minor.

Alternatives 2 and 3 would have no cumulative effects on the remaining plants and fungi on the R6 list; these species are considered unlikely to occur in the project area.

Cultural and Heritage Resources

Existing Condition/Affected Environment

Cultural resources (also known as heritage resources) include structures, sites, roads, trails, areas, and objects of scientific, historic or social value. They are irreplaceable, nonrenewable features documenting past human use on our nations lands. Within the National Forests, these sites document the prehistoric and historic life-ways of the American Indian, the routes and actions of the early explorers, trappers, and settlers, the industrial activities of logging, mining, and stock grazing, community resource use, the history of forest recreation, and National Forest administration. Any ground-disturbing activity, including the proposed action or its alternative, has the potential to damage the significant data, features, historic qualities, and natural settings of these sites unless adequate protections or mitigations are undertaken.

The entire Black Hills Project area was analyzed for cultural resources. The Black Hills Project Cultural Resource survey located numerous new sites including both prehistoric and historic components. Additionally, previously known sites were monitored for site condition (Durant and Clayton 2010).

The project area lies within Klamath Tribal territory. The Klamath were semisedentary hunter-gatherers who practiced a subsistence and settlement strategy based on seasonal availability of local plant and animal resources, with a focus on riverine and lacustrine resources (Silvermoon 1985:48-50). For example, mountain uplands, like the Black Hills project area, typically received seasonal use associated with subsistence needs such as summer deer hunting, berry picking and root gathering. Permanent villages were typically located in the lowlands clustered around Klamath Lake, Klamath Marsh and Sprague River, and were occupied during the winter months (Minor et al. 1979:96-98; Silvermoon 1985:37-39).

The Klamath Tribe was divided into six tribelets. The Upland Klamath are known to have occupied the upper Sprague River and Sycan River areas (Stern 1966:19; Spier 1930:10). The Klamath Indian name for Sycan Marsh is *saiga keni*, which means level, grassy place. The name Sycan was applied to the river as a result of its association with the marsh (McArthur 1974:710). The Black Hills area derives its name from the extensive amount of black obsidian found in the area.

Today, the Klamath, along with the Modoc and the Yahuskin band of the Northern Paiute, are part of the Klamath Tribes. In 1864, the Klamath Tribes signed the Klamath Lake Treaty ceding over 13 million acres of their lands to the United States government. About 1.1 million acres were retained for the Klamath Reservation. The boundary of the reservation shrank to 862,622 acres by 1954 due to several land exclusions (Zucker et al. 1983:107-108). Throughout this time, the project area stayed within reservation boundaries and was managed by the Department of the Interior, Indian Service (known today as the Bureau of Indian Affairs).

Under the Indian Service, the Black Hills area was managed for grazing and timber production. Although grazing had occurred in the area since 1860, the area was known as Grazing Unit No. 3 on the Reservation (USDA 1992: Purpose & Need-3; Nichols 1995:16). Logging was emphasized on the reservation after Congress passed legislation allowing the commercial sale of timber on reservations to benefit tribes in 1910. By the early 1920s, the reservation was carved up into sale areas (Tonsfeldt and Gray 2009:42). In 1928, the Klamath Agency, headquarters of the Klamath Reservation, offered three reservation timber sale units, one of which was the Black Hills Unit at 160 mmbf. The sales were prompted by a beetle infestation along the southern edge of the reservation (Tonsfeldt 1987:145-146). Beetle damage was first noted on the southern slopes of the Black Hills and Calimus Butte in 1918 (Durant 2006:131).

In 1954, Congress terminated the Klamath Tribe's federal status under the Federal Termination Act, while retaining the Tribe's right to utilize the former reservation lands to exercise their treaty rights. Private entities bought some of the old reservation land, but the majority of it became the Winema National Forest in 1961 (Zucker et al. 1983:110). The Fremont received large, scattered bocks of the former reservation land totaling 96,000 acres, one of which was the Black Hills area (Bach, 1981:14-

15). Like the Indian Service, the Forest Service also managed the Black Hills project area for grazing and timber production.

Although the Black hills project area is no longer reservation, the area has retained importance for the Klamath Tribes. For example, the Tribe has at times held their "Cultural Camp" in Teddy Powers Meadow. The camp is designed to teach young Tribal members about their heritage (USDA 1992: Existing Condition/Affected Environment-7). Termination did not end the Tribes' hunting and fishing Treaty Rights within the old reservation boundaries and they continue to practice those rights.

Currently, the cultural resources within the project area are in good condition. Conditions were not deemed excellent due to minor natural erosion and an increase in vegetation density and litter caused by 100 years of wildfire suppression; but visible signs of looting and effects of grazing were not detected. Current conditions of seven previously known sites and all of the newly recorded sites were determined by visual surface-only examination in the field. Field observations were documented in writing and through photography.

Climate Change as it Relates to Cultural Resources

The Earth's climate has fluctuated for 5-billion years; however, the most recent changes are now in the public eye. Climate change is not surprising to those who study Archaeology. Archaeologists have long studied the paleoenvironmental record and its influences on cultural change, such as the abrupt climate change called the Younger Dryas (also known as the Big Freeze), a cold dry period that occurred 12,800 years before present (BP), and Europe's Little Ice Age, that occurred 400 year BP. For example, in North America, human mega-fauna hunting strategies' were forced to adapt as mammoths became extinct at the end of the Ice Age 11,000 years ago.

In the northern Great Basin, the end of the Ice Age (from 12,300 BP to 9,500 BP, known as the Paleoindian Period in Archaeology) saw higher temperatures and higher annual precipitation levels resulting in very large pluvial lakes (Grayson1993:84). Conditions in the Early Archaic Period (10,500 – 7000 BP) saw even warmer temperatures, but dryer than the end of the Ice Age. Wet conditions returned during the Middle Archaic Period (7000-2000 BP), but they never returned to conditions seen at the end of the Ice Age. The Great Basin began to dry again in the Late Archaic Period (2000-125 BP) (Pettigrew 1985 and Musil 1995).

Some global climate prediction models suggest another abrupt event consisting of a warming trend; however these predictions are not universally accepted. In addition, predictions of the effects of a potential global warming trend are also not uniform. One prediction suggests that temperatures in the Great Basin will increase 3.6 to 9 degrees fahrenheit (2 to 5 degrees Celsius). A question remains as to how this warming trend will effect precipitation and evapotranspiration (Chambers 2008:29).

If the warming trend decreases the amount of available water and a regional drying trend occurs, then this would provide excellent preservation conditions for cultural resources. Prolonged drought may also encourage populations to abandon the dry areas in favor of cool-wetter environments. A reduction in local population would reduce physical damage caused by humans. However, dry

conditions could also bring severe wildfires that could destroy cultural sites and reduce populations of ethnobotanical plants important in Klamath Tribal culture.

If the warming trend increases the amount of available water, then cultural sites could be negatively affected. Artifacts may be displaced and site context may be disturbed by increased erosion and/or floods. Perishable artifacts (ecofacts) disintegrate in prolonged wet conditions. A positive indirect effect may be an increase in ethnobotanical plant populations.

Environmental Consequences

Alternative 1 – No Action

No direct adverse effects are expected to result from implementing the No Action Alternative because known cultural resource sites in the project area would continue to be protected from ground disturbing activities in accordance with the Federal Laws pertaining to the protection of cultural resources. An indirect, potentially adverse affect, may include the increased probability of a catastrophic wildfire. In Alternative 1, down dead woody material would continue to accumulate on sites increasing fuel loading over time. If or when a wildfire entered a cultural site, the greater fuel loading present could lead to greater fire intensity and higher soil temperatures. Cultural resources found within the soil deposits could be altered or destroyed.

Effects Common to Alternatives 2 and 3

Ground disturbance associated with thinning and extraction, decommissioning roads, and prescribed fire activities have the potential to impact cultural resources. Potential effects associated with the Black Hills Project would be avoided using the "Flag and Avoid" method in combination with good communication. Cultural site boundaries, incorporating a buffer (protective space) zone, would be flagged prior to project implementation and site locations would be shared with project leads. Slash piles, skid trails and landings would be placed away from known cultural site locations. Wherever possible, sites would be incorporated into the untreated areas within units over 20 acres in size. Underburning around cultural sites would be implemented following establishment of fire lines or other avoidance measures, such as special lighting patterns.

Combustible fuels would not be removed from cultural site locations and fuel loads would continue to accumulate within the flagged boundary increasing the potential for adverse effects caused by catastrophic wildfire. However, by reducing fuel loads around the sites through thinning and prescribed burns, the potential effects of an uncontrolled wildfire would be reduced.

Activities associated with the protection of the cultural resources within the Black Hills Project would have no lasting impact on climate change. The carbon imprint produced from two employees driving one vehicle out to the project area to flag cultural sites is not measurable.

Monitoring would continue throughout the duration of the project activities. If cultural resources were discovered during the implementation of proposed activities, project activity would be stopped in the immediate area while a plan to mitigate the effects is formulated. Once the mitigation work is completed and resources are protected, project activity would proceed.

Under the auspices of a memorandum of agreement with the Oregon State Historic Preservation Officer, the Forest Archaeologist has certified that the project would have no effect on listed or eligible cultural resources.

With implementation of resource protection measures described in Chapter 2, no direct, indirect, cumulative, irreversible, or irretrievable effects are expected on any cultural resource sites.

Range and Non-Forested Vegetation

Existing Condition/Affected Environment

Permitted Livestock Grazing

Grazing has been a land use practice in the project area since Southern Oregon was settled in the 1870s. Homesteading the lower elevation valleys, pioneers used the forests for summer pasture. The Black Hills area was formerly part of the Klamath Indian Reservation land. With the Klamath Termination Act in 1961, these lands were transferred to the Fremont National Forest for management. Permitted grazing on these lands transferred from the Bureau of Indian Affairs to the Forest. Allotment plans were first developed for these lands in 1965. The Forest was converting season-long, common allotments into single-permittee, managed grazing system allotments. This improved management and lower stocking levels led to improvements in vegetation and ground cover.

The Black Hills C & H Allotment and the Blue Creek Pasture are within the project area. C & H designates cattle and horse allotment and the Blue Creek Pasture is managed in conjunction with private land adjacent to the Forest. These allotments were analyzed in the North Fork Sprague Allotment Management Plans Environmental Assessment (EA) and associated Decision Notice (USDA Forest Service 2004).

Livestock grazing authorized under the Black Hills Allotment allows for up to 140 head of cattle during a grazing season of June 1 through September 30. Forage utilization standards range from 40 to 45 percent in dry meadows and 35 percent on floodplains.

Blue Creek Pasture provides grazing for up to two cow/calf pairs during the season of June 1 to October 31. Forage utilization standards range from 35 to 50 percent in dry meadows.

Distribution techniques, including salt location and active herding, have been successful in meeting short-term objectives (utilization rates). Long-term monitoring sites indicate satisfactory forage resource conditions with static trends (North Fork Sprague Allotment Management Plans EA).

Non-Forested Uplands Vegetation

Non-forested uplands within the project area are characterized by big sage/bunchgrass, low sage/bunchgrass and dry, moist and wet meadows. Approximately 4,000 acres or 14% of the project area consist of these non-forested vegetation types. These plant communities provide forage and other habitat elements for wildlife and domestic livestock. They contribute to the overall health and function of the watershed by providing water retention and recharge, sediment filtration, stream

channel stabilization, and mechanisms to reduce erosion and provide for essential soil processes (TR 1731-15 1998, TR 1737-19 2003, Hancock, J 1989, Riedl and Zachar 1994, Lowrance et al. 1986, Schlosser and Karr 1981). The non-forested uplands of the project area are described in the North Fork Sprague Allotment Management Plans EA (USDA Forest Service 2004) as follows:

Big Sage/Bunchgrass
The majority of the sagebrush-dominated communities are in mid-to-late seral ecological status, primarily due to the suppression of fire on these rangelands. Big sagebrush/bunchgrass sites are dominated by Wyoming or mountain big sagebrush shrub cover and bunchgrass herbaceous understory. Representative bunchgrasses include Idaho fescue, bluebunch wheatgrass, Sandberg bluegrass, and bottlebrush squirreltail. Although only lightly browsed by cattle, big sagebrush is represented as a climax shrub with significance for wildlife browse and cover. Big sagebrush communities are supported by a variety of soils, but are typically found on deep, well drained, alluvial clay loams. Mesic north aspect sites tend to support more Idaho fescue with bluebunch wheatgrass found on southerly exposures associated with well drained soils. Big sagebrush associations are particularly susceptible to juniper invasion with continued fire suppression or overuse by livestock.

Low Sage/Bunchgrass
Low sage dominated plant associations in the area occur on shallow to very shallow soils with rock fragments common (known as "scab-rock flats"). These types are mostly in late seral conditions, due to the lack of recent fires. The low sagebrush/fescue-squirreltail association supports low sagebrush, Idaho fescue, bluebunch wheatgrass, western needlegrass, Sandberg bluegrass, and bottlebrush squirreltail. Mesic sites will support one-spike oatgrass and prairie junegrass. Low sagebrush plant associations are found on shallow, heavy clay soils that may be saturated in parts of winter and early spring.

The majority of the sage types are thought to be outside the range of the historical fire disturbance regime for these types. Fire return intervals of 10 to 50 years maintained these types in a mix of structural height and ecological status. Fire suppression and the focus on timber management have caused these types to miss at least one and probably several fire disturbance events. Data collected during range monitoring indicates these types are mostly in late seral condition, with sagebrush dominating and grasses and forbs decreasing as cover components.

Meadows
Dry meadow associations are found on valley bottoms with little or no slope. The soils on these meadows are sandy to silty loams from both air-laid and extrusive alluvium. Vegetation is represented by the bluegrass-dry meadow association. The dominant species in this association are Kentucky bluegrass, Cusicks bluegrass, Baltic rush, smallwing sedge, western yarrow and longstem clover. Sites with excessively lowered water tables due to streambed downcutting may be dominated by silver sagebrush. Dry meadow sites have a water table at or near the surface in early summer and the entire soil profile is dry by early fall. These meadows can be sensitive to impacts with early season grazing due to saturated soils.

The hairgrass-sedge-moist meadow association is found in valley bottoms with little to no slope. The soils are alluvium with coarse loamy sands to silt loam textures. The vegetation is comprised of tufted hairgrass and various combinations of sedges such as Nebraska sedge and smallwing sedge. Baltic rush and pullup muhly are subordinate species found in this association. Small percentages of silver sage may inhabit these sites and are prevalent on sites that have unnaturally lowered water tables. Moist meadow sites typically have a water table within 45 inches throughout most of the growing season and the rooting zone is almost always saturated. A wet site is indicated by trace amounts of forbs such as American bisort and monkeyflower. Trace amounts of Kentucky bluegrass, meadow barley, and cinquefoils represent a fluctuation to a drier site. Kentucky bluegrass can become a weak dominant to tufted hairgrass due to overgrazing, but will not completely out-compete tufted hairgrass.

The bluegrass moist meadow association is found in valley bottoms, with little or no slope, on alluvium from air-laid pumice. Soils are coarse sandy loams to silty loams. The water table is usually within 45 inches of the surface through mid-July. Kentucky bluegrass and slenderbeak sedge dominate these meadows with hairgrass scattered but subordinate. Yarrow, aster, and dandelion increase with the loss of bluegrass.

The sedge-wet meadow association is comprised of wetland sedges such as Nebraska sedge, smallwing sedge, water sedge, bigleaf sedge, and beaked sedge. Also present in small amounts are baltic rush and pullup muhly. Tufted hairgrass will be present in trace amounts only. These sites are characterized by coarse sedge "mats" and have water at or near the surface year round. Arnica increases as the site deteriorates from the drying effects of down-cutting and over-utilization. Willows found on this association are often associated with abandoned stream courses or meanders.

Most of the meadow types are in satisfactory condition as defined by the Fremont Forest Plan (forage condition at least fair, with stable trends, and not classified as PC or PD; Forest Plan glossary page 30).

Environmental Consequences

Alternative 1 – No Action

Livestock grazing would continue as authorized under existing allotment permits. Overall, no action within the project area would result in most sagebrush and meadow communities remaining at the current level of functionality in the near future.

Water absorption and storage capacity would be negatively affected as juniper and other conifer encroachment continued toward increased canopy cover of non-forested plant communities. Interception of precipitation by the canopy would allow for higher evapotranspiration rates and less water would be available to support hydrologic function. Juniper and conifers have higher transpiration compared with other plant forms, which can add to lower soil moistures and groundwater flows. Over time this would decrease the competitive advantage of meadow plant species and to a lesser degree sagebrush plant communities. This would result in the desired, mid and late seral non-forested plant species being out-competed and they would begin to decline in

abundance. Long term, no action could lead to a downward trend in the functionality of these non-forested sites.

Effects Common to Alternatives 2 and 3

Livestock grazing would continue as authorized under existing allotment permits. In non-forested areas, plant species are limited by sunlight, water, and nutrients. Mid and late seral non-forested plant species have a competitive disadvantage as juniper and other conifer encroachment increases. Decreases in ground cover and increases in bare ground have also been documented. Removal of encroaching species would maintain plant species composition and cover necessary for function and maintenance of non-forested vegetation systems. Removal of encroaching vegetation would increase light, water, and nutrients available for non-forested plant species. Water absorption and storage capacity would increase as canopy cover decreases. Evapotranspiration rates would be reduced as canopy cover is decreased and less precipitation would be intercepted by tree limbs. Removal of juniper in big sagebrush sites would increase both species diversity and richness.

Over the years, timber harvest created openings scattered across the landscape. These openings increased forage, but also reduced shading for cattle during the heat of the day. Old harvest units are now regenerated and growing to the point where shade is increasing and forage is decreasing. Current harvest activities are aimed towards retention of large, older trees so openings are smaller and scattered. Planned vegetation treatment in the area would focus on thinning or removal of encroaching conifers in meadows and riparian areas and thinning around large trees to encourage old growth health. This type of activity would increase forage across an area so cattle are not concentrating in one spot. Opening riparian areas for deciduous growth could mean increased riding or fencing riparian areas to protect them.

Allowing prescribed fire to burn through non-forested plant communities, where it will carry, would result in a short term loss in plant cover and vigor. Early and mid seral species would occupy sites that are burned at high intensity. Areas that have a somewhat intact perennial species component that are burned at moderate to low intensity may see an increase in production as early as the following growing season. Long term effects to species composition and cover and overall plant community function would be beneficial. Late seral non-forested plant species would dominate and add to an increase in ground cover with a comparable decrease in bare ground. Overall forage quality and quantity would be improved. Prescribed burning across the landscape in the Black Hills Project would lead to improved forage conditions that are beneficial to domestic livestock grazing, but again may require additional management of grazing to keep cattle in appropriate areas.

Cumulative Effects

Past actions occurring in and around the Black Hills Project area included: the development of a road system, heavier grazing than is now practiced, fire suppression, timber management and prescribed burning. These activities also took place to some degree on the former Klamath Reservation, under the direction of the Tribes and the Bureau of Indian Affairs.

Ongoing activities with the potential to affect range resources or non-forested vegetation within the planning area include recreational camping, fishing, and hunting. Hunters that use horses bring their own hay so impacts to forage by other users are immeasurable. There are no foreseeable future

projects planned. Ongoing activities together with the actions included in Alternatives 2 or 3 would not result in cumulative effects on forage production or grazing capacity.

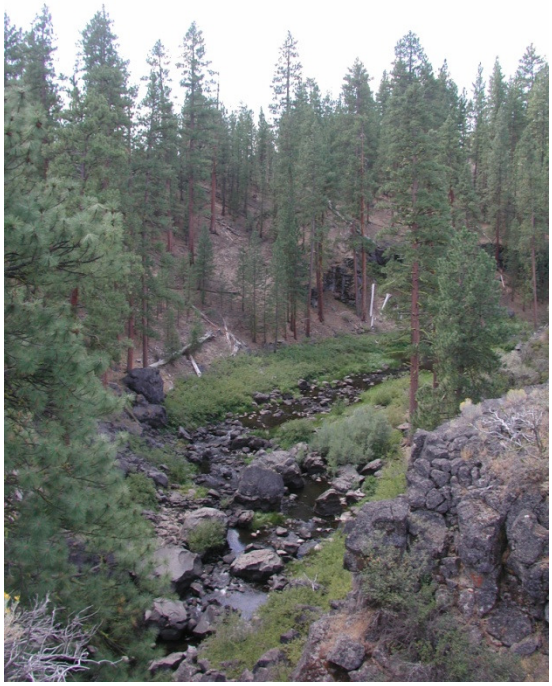
Recreation and Scenic Resources

Existing Condition/Affected Environment

The Fremont National Forest is relatively remote from major population centers therefore it does not receive as much recreational use as many other National Forests. The Forest does however provide important recreational opportunities for many local people and travelers. Today the majority of recreational use centers on the traditional themes of hunting, fishing and camping and driving for pleasure (Fremont National Forest National Visitor Use Monitoring Results, 2009). Some recreational users find the area appealing due to its' isolated nature and the solitude it offers.

There are no developed recreation facilities or trail systems within the project area. Dispersed camping occurs within natural forested settings in the area. Dispersed campsites are used primarily during the fall hunting seasons, although some use occurs throughout the year for family gatherings and fishing on the Sycan River.

The Wild and Scenic Sycan River provides opportunities for recreation in a river-type environment in this otherwise drier ecosystem. In addition to fishing enthusiasts, the river attracts those interested in float-tubing and kayaking, though the opportunity is limited to a two or three week period in the spring when peak flows occur. The unique features of the Sycan River are its distinctive scenery that varies from a steep canyon to broad meadows. Access to the river remains limited and compliments the natural character of the area (USDA Forest Service, Sycan Wild and Scenic River Management Plan, 1992).



The 1989 Forest Plan indicates that timber harvesting shall not be permitted in the scenic river corridor "unless specified in completed management plans". The Sycan Wild and Scenic River Management Plan (1992) stresses the scenic values of the river corridor guide the overall management, though some exceptions are acknowledged. Most pertinent for this project for the Sycan River is the exception that "Prescribed fire, using low to moderate fire intensities may be used to reduce hazardous fuel accumulations or to meet other resource objectives". What were open and park-like stands of ponderosa pine in the river corridor have turned into dense, multistory structures with weakened overstories and high fuel levels.

The Forest Plan allocates the foreground viewing zones of certain Forest roads and trails to MA 6 Scenic

Viewshed. Road 3462 through the middle of the Black Hills Project falls under this designation. The overall objective in MA 6 is to provide an attractive, natural appearing forest visual character. Under Forest Plan guidelines for MA 6B, these areas can be managed intensively for timber or other resources; however, visual quality is taken into consideration during management activities.

To ensure the visual integrity of landscapes in the foreground viewing zone of certain Forest roads and trails, including Road 3462, the Forest Plan (page 114) provides the following guidelines:

- Take extra care in the cleanup of logging slash.
- Adjust cutting boundaries to blend into the natural indigenous landscape.
- Attractive, natural-appearing Forest settings would be maintained with uneven-aged timber management, emphasizing large trees.
- Some of the natural settings within these scenic corridors may display evidence of management activity. However, to the casual observer this evidence will be unnoticeable or subordinate to the landscape.

Environmental Consequences

Alternative 1 – No Action

There would be no impacts to recreation and scenic resources under Alternative 1 because none of the proposed project activities would be implemented. Existing recreation opportunities would continue to be available. Forest conditions would continue to put the area at increased risk of stand replacing fire and insect and disease epidemics that would adversely affect the recreational and scenic values.

Effects Common to Alternatives 2 and 3

Existing recreation opportunities would continue to be available with implementation of any one of the action alternatives. In limited local areas opportunities for solitude would be interrupted in the short term as project activities are occurring. Dispersed camping and other recreational activities may also be disrupted or displaced short term while thinning treatments and prescribed fire are being implemented in specific portions of the project area.

Road decommissioning and road closures would reduce public motorized access to some areas and would reduce the opportunities to access all areas by motor vehicle for dispersed camping and for game retrieval during hunting activities. Decommissioning and closing roads in the project area would increase opportunities for solitude and could lead to improved big game hunting opportunities. Traffic would increase on existing roads in the area as log hauling occurs and as contractors and Forest Service personnel are working on projects. Forest road conditions would be improved for public use through routine maintenance and road improvements in the project area, benefitting those traveling for pleasure through the forest.

Utilizing prescribed fire in the Sycan Wild and Scenic River corridor would result in temporary short term visual effects such as blackening ground vegetation, scorching needles of low branches, or killing small trees. Prescribed fire, using low to moderate intensities to reduce hazardous fuel

accumulations in the river corridor is consistent with the Management Plan for the Sycan Wild and Scenic River (USDA Forest Service, 1992). Long term the treatment would be beneficial in reducing the potential for adverse effects from high intensity wildfire and would provide improved conditions for maintaining large old trees in the river corridor. Utilizing prescribed fire to manipulate vegetative conditions is consistent with the management goals for the Sycan River to maintain a visual quality objective of retention and manage the river corridor to preserve the natural character of the area. The action alternatives are consistent with Forest Plan Standards and Guidelines for MA 11 Wild and Scenic Rivers, where management is focused on preserving the undeveloped character and scenic quality of the river corridor, maintaining or improving water quality, improving fish and wildlife habitats, and providing recreation opportunities dependent on scenic, undeveloped river environments.

In the short term, log decks and slash piles would affect the scenic quality of the foreground viewing zone of Road 3462 during implementation. Prescribed fire would have the temporary visual effect of blackening ground vegetation, scorching needles of low branches, or killing small trees. Overall, implementation of thinning prescriptions and prescribed fire would result in more open forest conditions with old large trees more visually prominent on the landscape. Thinning and prescribed fire would result in long-term beneficial effects through improved forest health. Alternative 2 or 3 would be consistent with the Forest Plan objective in MA 6 to provide an attractive, natural appearing forest visual character in the scenic corridor of Road 3462.

Cumulative Effects

Recreation use in the area was extremely limited until the development of logging roads and vehicles that could travel on these primitive roads became available, sometime in the early part of the 20th century. As road access and conditions improved, more people used the area for hunting, fishing, camping and firewood gathering. Recreation use has remained fairly steady, at low to moderate use levels, over the past decade. Ongoing livestock grazing does not influence recreational uses of the area to any significant degree. While motor vehicle access would be reduced in some areas, implementation of Alternative 2 or 3 would not be expected to change recreation use of the area in any significant manner and would not result in cumulative effects to recreation resources.

The effects of the action alternatives along with the continued activities of livestock grazing, recreation, road maintenance and firewood gathering would not impact to any noticeable degree the scenic characteristics of the Sycan River or Road 3462 corridor.

Inventoried Roadless Area, Potential Wilderness Area, and Other Undeveloped Areas

Existing Condition/Affected Environment

This section discloses the potential impacts the Black Hills Project activities would have on these three interrelated resources.

Inventoried Roadless Area
In 1972, the Forest Service began identifying roadless areas for wilderness consideration through the Roadless Area Review and Evaluation (RARE I). In 1979 the agency completed RARE II, a more extensive national inventory of roadless areas for consideration of wilderness potential. The Fremont National Forest incorporated RARE II data to develop inventories of roadless areas into the Forest Plan (1989, Fremont Forest Plan FEIS, Appendix C). There are no roadless areas, as identified in the Forest Plan, within or adjacent to the Black Hills Project area.

In November 2000, the Forest Service issued the Final EIS for *Roadless Area Conservation*, which identified boundaries of Inventoried Roadless Areas (IRAs) in a set of maps contained in Volume 2 of the EIS (http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsmrs_072326.pdf). There are no IRAs within or adjacent to the Black Hills Project.

Potential Wilderness Area
Forest Service regulations at 36 CFR Part 220.5(a)(2) (July 2008) require consideration of classes of actions normally requiring environmental impact statements, including "*Proposals that would substantially alter the undeveloped character of an inventoried roadless area or a potential wilderness area"*. The criteria used to identify potential wilderness areas are contained in Forest Service Land Management Planning Handbook FSH 1909.12, Chapter 71.1 and 71.11.

There are no undeveloped areas of 5,000 acres or more (criteria 1) without forest roads (criteria 3) within or adjacent to the Black Hills Project area (Map Figure 2-5). Areas without roads (criteria 3) and less than 5,000 acres (criteria 2) were analyzed to determine if they met one or more of the following criteria:

- Criteria 2a: Could be preserved due to physical terrain and natural condition
- Criteria 2b: Were self contained ecosystems such as islands that can be effectively managed as a separate unit of the National Wilderness Preservation System
- Criteria 2c: Were contiguous to existing wilderness, primitive areas, Administration endorsed wilderness areas, or potential wilderness in other Federal ownership, regardless of size

No areas were identified within the Black Hills Project that meets potential wilderness criteria 2a, 2b, or 2c and criteria 3.

Other Undeveloped Areas
Undeveloped areas are defined as any area, without the presence of a classified road that is either 1,000 acres in size, or is adjacent to an IRA and is not included in the map set for the Final EIS for Roadless Area Conservation (November 2000) and also does not meet criteria for potential wilderness. There are no Forest-wide or Management Area standards specific to undeveloped areas.

As part of their response to scoping for the Black Hills Project, Oregon Wild (formerly ONRC) suggested that any treatments deemed necessary in the unroaded areas identified in *ONRC's 2003 scoping letter* should be accomplished preferably by non-commercial methods with selective fuel modification followed by prescribed fire. Our analysis determined that none of the areas identified

on a map produced by ONRC for their *2003 scoping letter* are within the project area (map available in project file).

In the early 1920s, when the Black Hills area was part of the Klamath Indian reservation, the area was managed for grazing and timber production (Durant, 2010). When the Black Hills area became part of the Fremont National Forest in 1961, the Forest Service also managed the Black Hills project area for grazing and timber production. The Black Hills Project and surrounding area are extensively roaded (Map Figure 2-5). With the exception of Spodue Mountain, the area is generally flat, which made it easy to create roads throughout the area. In the late 1980s a road system was designed and built to access areas of Spodue Mountain.

Environmental Consequences

Effects Common to All Alternatives

There would be no effects to roadless areas, potential wilderness areas, or other undeveloped areas with the selection of any of the alternatives, as no areas of a size and configuration sufficient to protect the inherent special characteristics associated with roadless conditions, potential wilderness or otherwise undeveloped conditions exist in the Black Hills Project area.

Cumulative Effects

Timber harvest and road building has occurred in the past within all of the Black Hills Project area to one degree or another. Historic logging primarily included removal of large overstory ponderosa pine using ground based logging systems.

Other than timber harvesting, the primary additional past activities that have occurred include livestock grazing within all areas for at least the past 100 years, fire suppression activity for approximately that same length of time, and dispersed recreation, including hunting.

There would be no effects to roadless areas, potential wilderness areas, or other undeveloped areas with the selection of any of the alternatives, therefore the Black Hills Project would not result in any cumulative effects to these resources.

Transportation/Roads

Existing Condition/Affected Environment

The existing transportation system was primarily developed in response to the needs of timber management: as a result, a large road system was developed. In the past it has been maintained through timber sale revenues and capital investment programs. With the decline in timber harvest activities and reduced availability of Regional funding sources, current road conditions have steadily deteriorated from the lack of periodic road maintenance and reconditioning. There have been no timber sales in the project area since the late 1980s.

The consequences of this deferred road maintenance include brush and tree encroachment into the travelways, ditchline deterioration from slope ravel and brush encroachment, loss of roadway surfacing and roadway erosion and rutting.

The Forest Plan provides management direction and establishes standards and guidelines pertaining to road management:

- The Forest Plan sets as a goal, "a safe and economical transportation system providing efficient access for the movement of people and materials" (page 51).

- The transportation system will serve long-term multiple resources … (with)… the minimum system necessary to provide access for the activities authorized under management area direction (page 116).

- Overall density for roaded areas of the Forest will not exceed 2.5 miles per square mile (page 116).

- All system roads will be operated and maintained to protect the resources, perpetuate the intended road management objective, and promote safety (page 116).

The desired road management strategy for Maintenance Level (ML) 1 (closed) and 2 (high clearance vehicles) roads would be to move these roads towards a "self-maintaining" condition. Typically, annual road maintenance is not performed on ML 1 and 2 roads; they are maintained through project work, such as the Black Hills Project.

ML 3 (passenger car accessible) roads are currently maintained on a rotational basis by the Interagency Road Crew stationed at the Lakeview Ranger District.

Current Road Densities

There are approximately 242.5 miles of Forest system roads within the Black Hills Project planning area. Current Forest Service road densities exceed the Forest Plan's objective of 2.5 miles per square mile, by 1.83 miles in the Snake River subwatershed, by 3.21 miles in the Sycan River subwatershed and by 3.56 miles in the Marsh Reservoir subwatershed (see Table 3-24 below).

Table 3-24. Current Forest Service Road Densities for Black Hills

SUBWATERSHED	ALL LANDS	FS LANDS
Entire Project Area	5.37	5.41
Snake River	4.36	4.33
Sycan River	5.64	5.71
Marsh Reservoir	6.06	6.06

Road Density = miles of road / square miles of land base

Forest Level Roads Analysis

The Forest Supervisor of the Fremont-Winema National Forest formed an Interdisciplinary Team to develop a Forest-level roads analysis in 2000 for the Winema and 2002 for the Fremont. The Fremont and Winema National Forests were administratively combined in 2002. The Forest Roads

Analysis Team produced a forest roads analysis report and transportation atlas documenting the six-step interdisciplinary process and recommendations resulting from the process for ML 3, 4 and 5 roads. ML 3, 4, and 5 roads are maintained for low clearance vehicle access with the highest level of travel comfort at ML 5. These roads form the main or "backbone" road system for the Fremont-Winema National Forest. Where appropriate, recommendations are made for future actions that will reduce risks of unacceptable environmental disturbance and increase the benefits provided by these system roads.

Project Level Roads Analysis

The Lakeview/Bly District Ranger directed that a project level roads analysis be conducted for the Black Hills Project planning area. The IDT met three times to determine 1) road evaluation criteria for each discipline, 2) road management recommendations for each road within the project area including; remain in existing condition, close, decommission, change road maintenance level and 3) to update and finalize the road management recommendations based on field checks conducted by the Zone Hydrologist and Roads Manager and input from Marc Valens, a local landowner in the area.

The specific road management recommendations made by the roads analysis group are displayed in the *Black Hills Roads Analysis* (June 2010) found in the project record and in the table in Appendix A of this EA and are common to all project action alternatives.

The results of this analysis are recommendations to close 30.34 miles and decommission 93.89 miles of Forest system roads. These road management activities are described in Chapter 2 Alternatives.

The Roads Analysis Team also recommended maintenance level changes affecting approximately 22 miles of Forest roads as displayed in Table 2-1 in Chapter 2 Alternatives.

Forest's Motorized Travel Management Plan

In November 2005, the U.S. Forest Service published the "*Final Travel Management Rule,*" which directs National Forests to designate a system of roads, trails and areas for motorized vehicle use. The *Travel Management Rule* provides a consistent framework for motor vehicle use on National Forests and grasslands.

The Fremont-Winema National Forest has completed its Motorized Travel Management Project Environmental Assessment and the Decision Notice was signed on July 8, 2010. The decision applies to all National Forest System lands managed by the Forest. Implementation of the decision will begin with the publication of the Motor Vehicle Use Map (MVUM) sometime in 2011. After publication of the MVUM, motor vehicle use is allowed only on designated roads and trails and in designated areas. The MVUM does not apply to winter use of roads by snowmobiles, nor does it apply to Klamath tribal members exercising their treaty rights to hunt and gather on former reservation lands.

Road Activities Related to Project Treatments

Field reviews to determine construction, reconstruction and maintenance needs for the project's vegetation treatments were conducted by the South Zone Roads Manager in the fall of 2008 and the spring of 2009.

There are approximately 200 miles of Forest system roads identified for potential timber sale log haul within the Black Hills Project. Most of these are either ML 1 or ML 2 roads. Roads 3462, 3450 and 3445 are the only ML 3 roads to be used as haul routes by this project.

No new permanent road construction is proposed by this project.

Road Maintenance
Treatment related road maintenance may take place on approximately 200 miles of Forest roads. Road maintenance activities for a commercial sale are performed during three general timeframes within the life span of the sale: pre-haul, during haul, and post haul.

- Pre-haul road maintenance prepares the project road system for heavy truck traffic related to the sale.
- During haul maintenance sustains optimum road conditions favorable to continued haul activity.
- Post haul maintenance ensures that road elements within the sale area and on the haul routes within the National Forest are returned to their full operational maintenance level standards.

Timber sale road maintenance activities generally consist of surface blading, ditch pulling, light to medium roadside brushing, culvert cleaning, small quantity cutbank slump removal, spot surfacing addition/replacement and maintenance of existing drainage structures (i.e. water bars, drain dips).

Temporary Roads
Up to 5 miles of temporary road construction is proposed for project log hauling purposes. Temporary roads would be built to the lowest possible standard to facilitate timber removal. All temporary roads would be decommissioned following completion of harvest activities, and would not add to the long term road system density.

Environmental Consequences

Alternative 1 – No Action

Under Alternative 1, only routine maintenance and repair of existing road facilities would occur. As in the recent past, there would be occasional opportunities to replace or upgrade road/stream crossings and improve road surface drainage as funding allowed.

There would be no comprehensive management activities to recondition and maintain road systems within the Black Hills Project area. This would likely result in continued general deterioration of road conditions. Potentially this could include vegetation encroachment, cutbank and fill slope failure and culvert failure. No temporary roads would be constructed or decommissioned.

None of the road management recommendations found in the Black Hills Roads Analysis Report would be implemented. Road densities within the project area's subwatersheds would remain high and would not move toward achieving Forest Plan objectives.

Effects Common to Alternatives 2 and 3

Alternatives 2 and 3 include approximately 200 miles of potential timber sale road maintenance leading to an expected overall improvement in conditions for those project roads. Road maintenance activities are designed to effectively drain storm waters from existing roadways. Therefore, they have the potential to improve watershed hydrologic function relative to unmaintained forest roads (see this project's Hydrology Report for additional discussion and analysis of roads and hydrologic function).

This road maintenance would effectively reduce sediment delivery to streams and lower the potential risk of culvert and fill failures both during, and for a number of years following, project treatments. Although routine road maintenance occurs on ML 3 roads, this may be the only opportunity for a substantial period of time, to perform road maintenance on ML 1 and 2 roads in this area.

The *Black Hills Roads Analysis* report recommends closing 30.34 miles of roads and decommissioning 93.89 miles. Between the MVUM and the Black Hills Project road management proposals to close and decommission approximately 124 miles of system roads, motorized access by the general public in the Black Hills area would be reduced. However, these activities would come close to satisfying Forest Plan direction to reduce overall road densities across the Forest to 2.5 miles per square mile.

Road densities following full implementation of the road management recommendations are shown in Table 3-25 below.

Table 3-25. Road Densities – Post Implementation of Road Management Recommendations

SUBWATERSHED	ALL LANDS	FS LANDS
	Road Densities Post Implementation	
Entire Project Area	2.71	2.64
Snake River	2.44	2.36
Sycan River	2.77	2.69
Marsh Reservoir	3.10	3.10
	Road Density Reduction	
Entire Project Area	2.66	2.77
Snake River	1.92	1.97
Sycan River	2.87	3.02
Marsh Reservoir	2.95	2.95

Road Density = miles of road / square miles of land base

Implementation of all road management recommendations would also reduce future funding needs for road maintenance on 124.23 miles in the Black Hills Project subwatersheds. Reforestation potential on the decommissioned roads would be approximately 159 acres.

The road management activities recommended under the analysis allow for continued reasonable and safe access for timber stand management, fire suppression, range management, terrestrial and aquatics species protection and public use/recreation within the Black Hills Project area.

There would be up to 5 miles of temporary roads built to provide access for timber removal from the project area. Since temporary roads are decommissioned following use and are not included in the

permanent Forest road system, they have no effect on road density and do not provide long term administrative and public access to national forest lands.

All road activities associated with the Black Hills Project would follow the Fremont Roads Best Management Practices (BMPs) to reduce or prevent resource damage. The BMPs are found in Appendix B of this document.

Cumulative Effects

Access for livestock grazing, recreation, and firewood gathering do not impact road conditions because very little use occurs under wet spring conditions and the otherwise low use (as evident by the amount of brushed in roads) has minimal effect on the road system. These ongoing actions will have no measurable cumulative effects to road conditions with the proposed action. Public safety on the roads available for motorized use would be improved by the road maintenance for the commercial sale activities.

Invasive Plants/Noxious Weeds

Introduction

The Federal Noxious Weed Act of 1974, as amended, requires cooperation with State, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to management and control of noxious weeds (USDA Forest Service, 1995c). The Forest Service Manual describes a noxious weed as a plant that is aggressive and difficult to manage, poisonous, toxic, parasitic, a carrier or host of serious insects or disease, and being native or new to or not common to the United States or parts thereof (USDA Forest Service, 1995e). In the Forest Service Manual (USDA Forest Service, 1995d), the objective states that an integrated weed management approach should be used to control and contain the spread of noxious weeds on and adjacent to National Forest System lands.

The Fremont Land and Resource Management Plan (Fremont Forest Plan) directs that noxious weeds be controlled or eradicated to the extent that funding is available. In 1998, the Environmental Assessment for the Management of Noxious Weeds (the 1998 EA) was completed for the Fremont National Forest. The 1998 EA analyzed the effects of various treatment methods including manual, biological, cultural, mechanical, and chemical.

In 2005, the Record of Decision for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plant EIS came out (USDA Forest Service, 2005). The 2005 Record of Decision (2005 ROD) integrated Prevention Standards into Forest Plans across the region. The Fremont-Winema National Forests Invasive Species Prevention Practices was produced in 2005 and updated to include any additional material from the 2005 ROD. These prevention measures should be followed for all future management activities that occur within the project area. Applicable direction from the 2005 ROD can be found in Chapter 2 of this EA under Project Design and Resource Protection Measures and Monitoring. The Black Hills Project contains no specific treatment of noxious weeds on National Forest System lands. Regardless of which alterative is

chosen for this project, noxious weed treatment is an on-going program under the analysis and decision issued from the 1998 EA.

Existing Condition/Affected Environment

The 2009 noxious weed GIS layer was used in conjunction with the project boundary layer to assess known weed sites. The majority of the survey work completed within the project area has been on major roads. The initial look showed 10 noxious weed sites (1.5 acres) located within the project area. Table 3-26 breaks down the number of noxious weed sites by species and acreage within the project area.

Table 3-26. Noxious Weed Species within the project area

Species	Number of Sites	Total Acres Infested
musk thistle	7	1.2
Canada thistle	1	0.1
Dalmatian toadflax	1	0.1
St. Johnswort	1	0.1
Total	**10**	**1.5**

The following are descriptions of the noxious weed species that are known to occur within the project area.

Musk thistle: Musk thistle (*Carduus nutans*) is a taprooted biennial that germinates and grows into a rosette the first season (Beck, 1999). The second season, the plant bolts, produces seeds, and then dies (Beck, 1999). Musk thistle reproduces solely by seeds, which are dispersed by wind, water, wildlife, livestock, and human activities (Beck, 1999). Seed may remain viable up to 10 years. Population size can fluctuate from year to year with climatic conditions. Rapid increases may occur following disturbances which create bare soil. Musk thistle has been established in southeastern Klamath County for decades, and is less abundant in Lake County. On the Forests it is found most often in plantations, in burns, along roadsides, along powerlines, and on landings within mixed conifer or upper elevation ponderosa pine forest types. It also can occur in riparian areas. The largest infestations on the Forests occur south of Highway 140 on the Bly District, where plants are generally scattered throughout old burns and clearcuts. In this area, large populations also occur on adjacent ownerships, which increase the seed source and difficulty of control. There are 7 sites of musk thistle (1.2 acres) within the project area.

Canada thistle: Canada thistle (*Cirsium arvense*) is a perennial species with an extensive creeping root system (Morishita, 1999). Canada thistle primarily reproduces vegetatively from horizontal creeping roots, but can also reproduce from seed (Morishita, 1999). Buried seed can be viable up to 26 years. Seed is dispersed primarily via wind, water, and human activity (Morishita, 1999). On the Forests, Canada thistle is most often found in disturbed sites such as roadsides, landings, and plantations. However, the species also has the ability to invade meadows and riparian areas. There is 1 site of Canada thistle (0.1 acres) within the project area.

Dalmatian Toadflax: Dalmatian toadflax (*Linaria dalmatica*) is a deep-rooted perennial species that reproduces by seeds and by vegetative buds on the roots (Lajeunesse, 1999). Reproduction by seed is more important for initiating new toadflax infestations, while vegetative buds on the roots is

important for increasing the plant density of a site (Lajeunesse, 1999). Dalmatian toadflax can be found invading disturbed sites such as roadbanks, areas near dwellings, and gravel pits (Lajeunesse, 1999). There is 1 site of Dalmatian toadflax (0.1 acres) within the project area.

St. Johnswort: St. Johnswort (*Hypericum perforatum*) is a perennial species with a deep penetrating taproot that reproduces by seed and lateral runners (Piper, 1999). Seed is dispersed by wind, animals, water, and human activity (Piper, 1999). Seed viability in the soil is 6-10 years. This species can become established in degraded or pristine range and forestlands. On the Forests, it is most abundant on Klamath District, where there is close proximity to a large seed source on the west side of the Cascades. There is 1 site of St. Johnswort (0.1 acres) within the project area.

Environmental Consequences

Effects Common to All Alternatives

The consequences of noxious weed infestation can include alteration of the structure, organization, or function of ecological systems (Olson, 1999). Noxious weeds have the ability to deplete soil, water, and nutrients to levels lower then native plant species can tolerate, allowing noxious weeds to out-compete native vegetation (Olson, 1999). Weed infestation can therefore lead to a decrease in native plant species, which can alter the ability of wildlife and livestock to find suitable, edible forage.

At the watersheds level, noxious weeds can alter the seasonal water flow (Olson, 1999). Noxious weeds create more erosion than native plant species because they have fewer shallow roots, which would soak up and hold water. Noxious weeds also have less canopy closure then native plants. This increases the amount of sunlight directly hitting the soil, increasing the amount of water evaporated at the soil surface. When moisture cannot penetrate into the soil, the result is an increase in soil surface run-off, leading to an increase in erosion and deterioration in watershed conditions.

With the 1998 EA and a Forest Service noxious weed treatment contract in place, noxious weed sites on National Forest System lands will be treated in accordance with funds available regardless of which alternative is chosen for the Black Hills Vegetation Management Project.

Alternative 1 – No Action

The No Action alternative has no proposed activities associated with it. Without the proposed ground disturbing activities occurring, the increase in potential noxious weed habitat would not occur. In the No Action alternative, fuels reduction activities would not occur. These types of activities would reduce the risk for a future high severity fire in the project area. Reducing the risk for a future high severity fire also reduces the future risk of creating noxious weed habitat.

Over all, this alternative would not contribute to the introduction or spread of noxious weeds to the project area.

Alternative 2 – Proposed Action

In the short term, Alternative 2 would affect the potential for noxious weed infestation in the project area in two main ways. First, ground disturbing activities, such as cutting and removing trees; prescribed burning; and pile burning and other on-site activity fuels treatments such as mechanical slash crushing, would increase the amount of open disturbed habitat available for infestation. Second, increased activity and traffic would heighten the chance for introduction of noxious weed seeds from vehicles and equipment. The potential for noxious weed infestation would therefore increase proportionate with the amount of ground disturbing activity in each action alternative. The activities proposed in Alternative 2 however, would reduce the future risk for a high severity fire. Decreasing the risk of high severity fire would reduce the potential to create noxious weed habitat. Overall, Alternative 2 would produce a risk of introducing and spreading noxious weeds within the project area.

Implementing prevention practices including weed free equipment and avoidance of known weed infestations would decrease any potential risk for establishment of new noxious weed sites. The Forest's weed control program along with the Project Design and Resource Protection Measures and monitoring included in the action alternatives would significantly minimize the potential for spread and establishment of noxious weeds. Alternative 2, with the included Project Design and Resource Protection Measures, would be compliant with the Fremont Forest Plan, as amended by the 2005 Record of Decision for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plant EIS, the 1998 Fremont EA for the Management of Noxious Weeds, and the 2005 Fremont-Winema National Forest Invasive Species Prevention Practices.

Alternative 3

Alternative 3 would produce more open conditions that Alternative 1, but about the same amount of open conditions as Alternative 2. Like Alternative 2, Alternative 3 would affect the potential for noxious weed infestation in the project area through ground disturbing activities and increased vehicle traffic. Alternative 3 would also have a risk of introducing and spreading noxious weeds within the project area.

Implementing prevention practices the same as in Alternative 2 would decrease any potential risk for establishment of new noxious weed sites. The Forest's weed control program along with the Project Design and Resource Protection Measures and monitoring included in the action alternatives would significantly minimize the potential for spread and establishment of noxious weeds. Alternative 3, with the included Project Design and Resource Protection Measures, would be compliant with the Fremont Forest Plan, as amended by the 2005 Record of Decision for the Pacific Northwest Region Invasive Plant Program Preventing and Managing Invasive Plant EIS, the 1998 Fremont EA for the Management of Noxious Weeds, and the 2005 Fremont-Winema National Forest Invasive Species Prevention Practices.

Cumulative Effects

All ongoing activities have an invasive plant prevention plan. The current invasive plant species control program has been successful in reducing the spread of noxious weeds and preventing new infestations with all ongoing activities. Public use of system roads for recreation and firewood gathering would continue to pose a risk to introduce or spread invasive plants. By continuing to

keep the roads as free of invasive plants as possible, the potential of spreading invasive plants is minimized. Ongoing actions along with the proposed actions of Alternative 2 or 3, with associated Project Design and Resource Protection Measures and monitoring, would not result in cumulative effects to invasive plants.

Public Health and Safety

Warning signs would be posted as required by contract provisions in commercial harvest activity areas. Public safety issues, including the need to abate dust on roads open to the public, would be addressed with contractors during contract pre-work sessions. A site-specific burn plan would be prepared prior to implementing prescribed fire. The plan would ensure that resource management objectives are clearly defined, and that site environment and human health are not harmed. The plan would contain a risk assessment and actions to prevent escape, and a contingency plan for actions to quickly contain an escaped fire. Warning signs would be posted during prescribed fire activities to provide for public safety in the project area. Information on prescribed fire activities would be provided to the public through Forest news releases, advertisements in local newspapers and radio or television announcements. There would be no significant effects to public health or safety as a result of implementing any of the alternatives of the Black Hills Project analysis.

Prime Farmland, Rangeland, and Forestland

The Secretary of Agriculture issued Memorandum 1827 which is intended to protect prime farmlands and rangelands. The project area does not contain any prime farmlands. Prime forestland is not applicable to lands within the National Forest System. Adverse effects on prime rangeland not already identified in the Forest Plan FEIS are not expected from implementing the alternatives.

Floodplains and Wetlands

No direct, indirect, or cumulative adverse effects to floodplains or wetlands as described in Executive Orders 11988 and 11990 would occur with implementation of the action alternatives. Adherence to INFISH (1995) direction provides the mechanism by which the Forest Service complies with Executive Orders 11988 and 11990.

Civil Rights and Environmental Justice

Executive Order 12898 on environmental justice requires federal agencies to identify and address any disproportionately high and adverse human health or environmental effects on minority and low income populations. With the implementation of any of the alternatives, there would be no disproportionately high adverse human health or environmental effects on minority or low-income populations. The actions would occur in a remote area and nearby communities, including members of the Klamath Tribes would mainly be affected by positive economic impacts as related to timber harvest or contracts implementing non-commercial thinning and other restoration activities.

The proposed alternatives would not adversely affect consumers, civil rights, minority groups, or women. Federal contracts include non-discrimination requirements.